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The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

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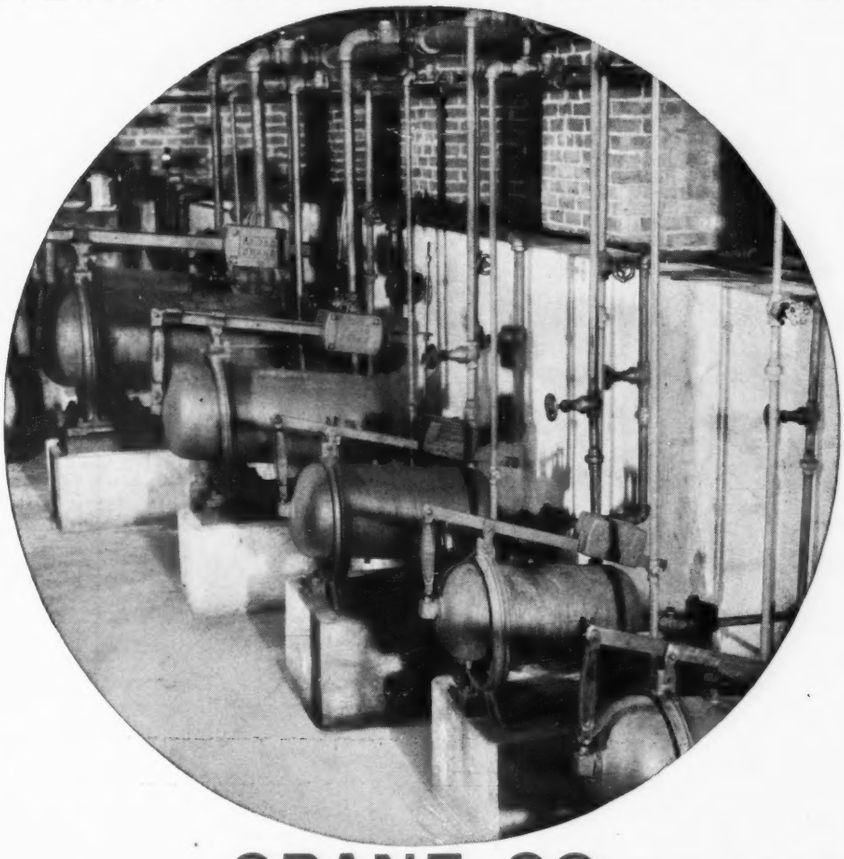
CRANETILT STEAM TRAPS SAVE COAL



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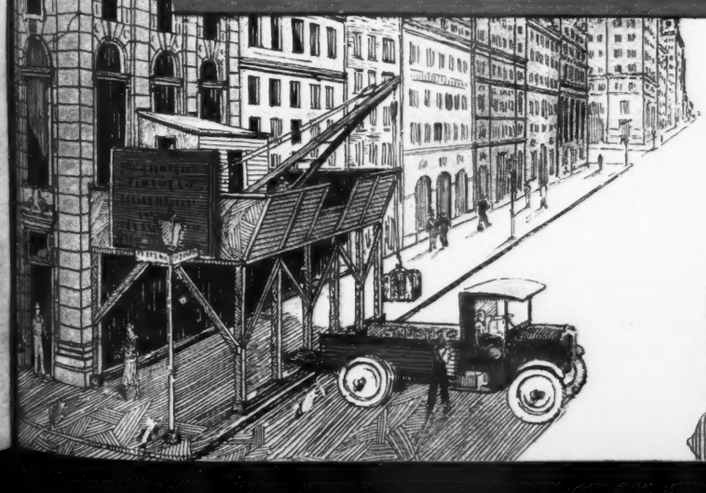

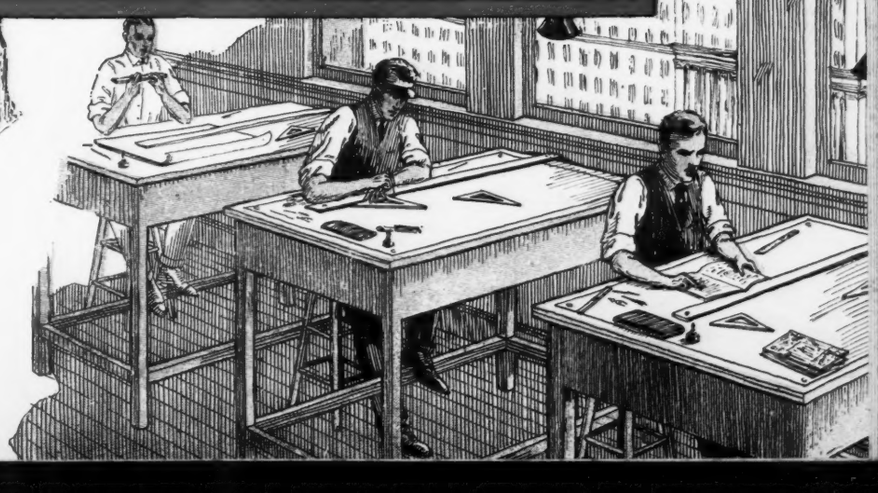

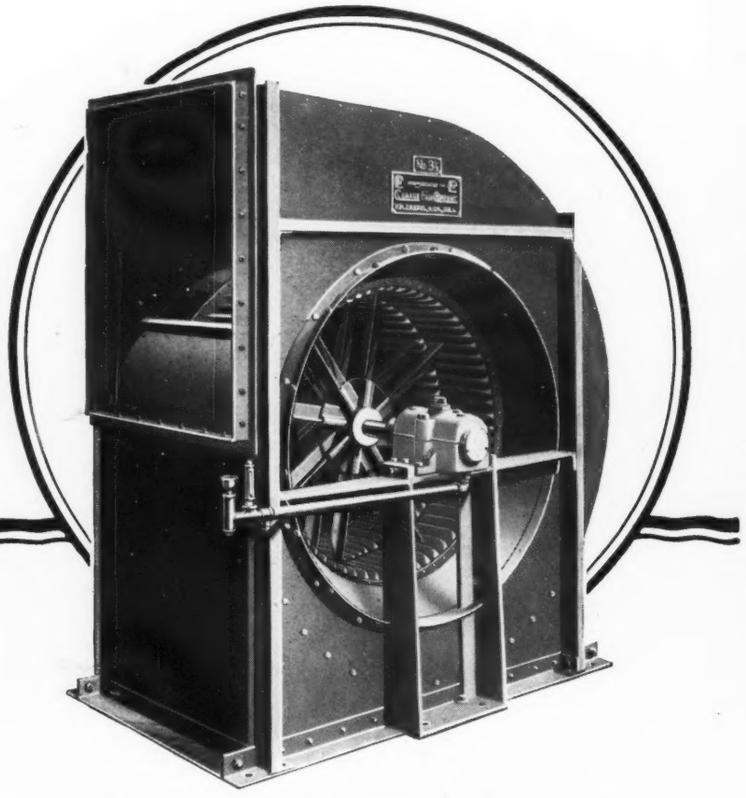

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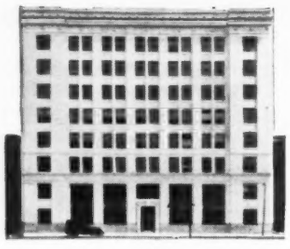
Multiblade Fans Were Recently Installed in These Buildings



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Construction Counts

Disregard for the moment capacity, speed, outlet velocity and efficiency, and dig down to bed-rock fan construction. Not that performance characteristics are unimportant, but of what value is high efficiency, for instance, if the fan is poorly built and soon wears out? Comparison of engineering data will establish that Clarage Kalamazoo Multiblade Fans are just as economical in operation as other makes, while investigation, either by perusing our literature or by examining a Clarage heating and ventilating installation, will convince you of the superior construction of the Multiblade Fans.

It has been our ideal to produce fan equipment that endures—that will give satisfactory service ten, twenty years hence. Engineers who always select Clarage Kalamazoo Multiblade Fans and installations of a decade ago, which operate now as satisfactorily as the day they were made, are evidence that we have progressed toward our ideal. Construction counts!

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Specify the New Herbert

for your next Boiler installation

The Herbert Portable Magazine Water-tube Smokeless Boiler fulfills every requirement

No flues to clean.
Burns soft coal successfully.
Carries fire twelve to fifteen hours with one fire.
No gas from any grade of coal.
Has downdraft and direct draft to suit weather conditions.
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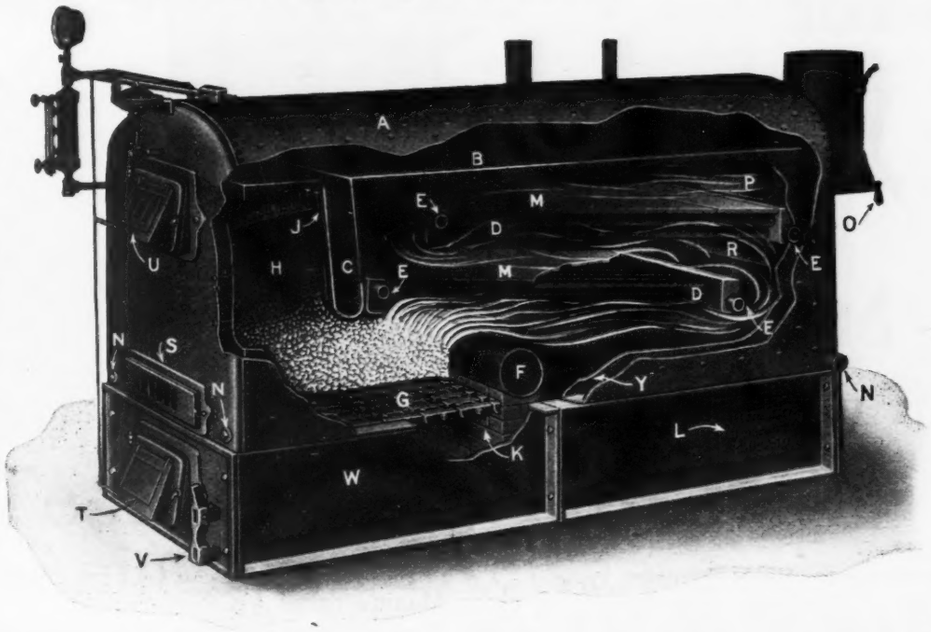
Has wrought-iron tubes, which means twice the life of the average boiler.
Has twice the fire travel of any boiler of its size.
It is all shell surface, which means economy.
Steady water line—cannot prime or syphon.
Can be set in brick, which gives one more return of the hot gases.
No brick arches or other flimsy devices.
Natural draft and the highest economy.
Occupies less space than any boiler built, to do what it will do.
Built in sizes from 1,000 sq. ft. to 25,000 sq. ft.



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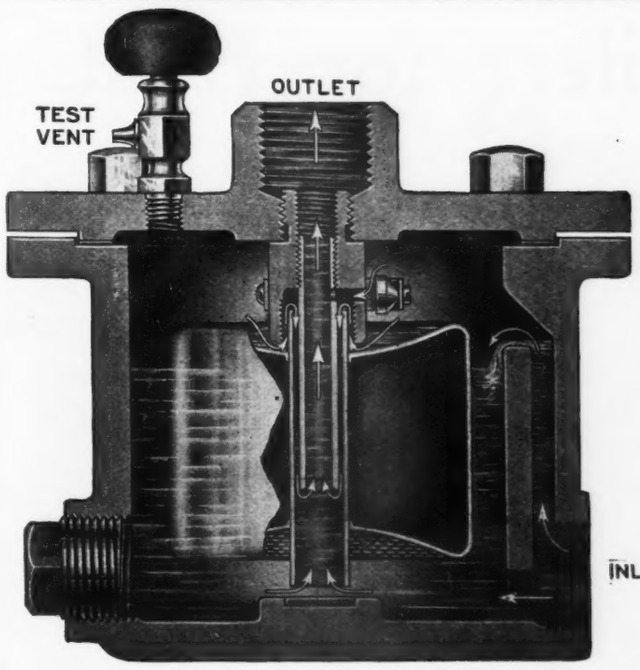

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FOR DIRECT OR INDIRECT COILS OR ANY LOCATION WHERE LARGE QUANTITIES OF WATER ARE TO BE DISCHARGED

Operates automatically either with or without mechanical suction on return line.

No complicated parts to stick or get out of order.

No small openings to clog up with sediment or scale.

Free passage of water—rapid and steady vent of air and passes no steam.

Combined action of flotation for water and all metal thermostatic vent for air together with relief of air through water seal makes the ideal trap for heavy service.

Adjusted and tested at factory and shipped ready for installation, to work automatically from below atmosphere on up to 25 pounds steam pressure.

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"Oil City Boilers" will burn any kind of fuel and are constructed to the requirements of all States and to the Code of Boiler laws as adopted by the American Society of Mechanical Engineers.

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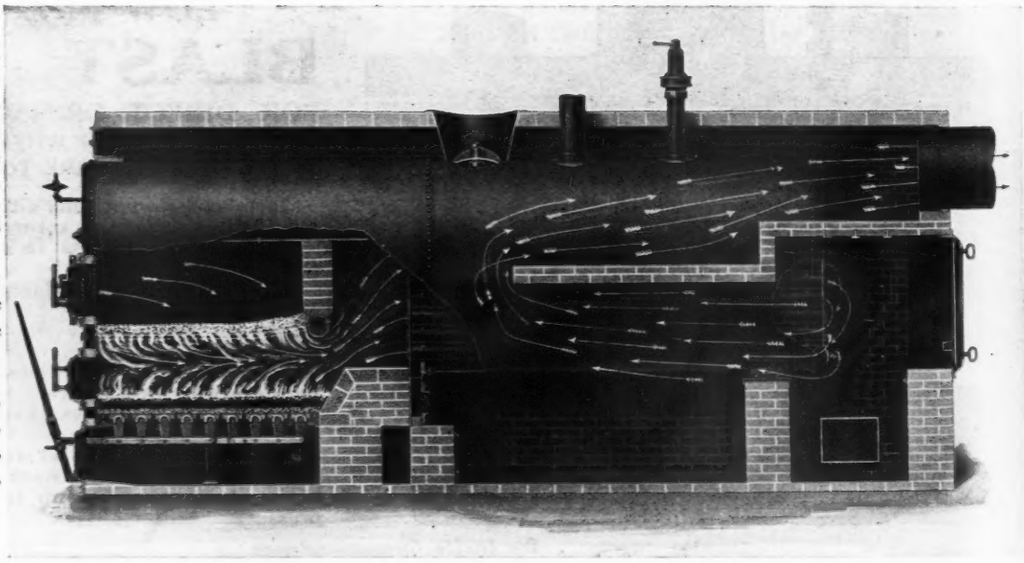
Safety, Efficiency, Economy, Dependability, Durability, No Repairs, Require little attention, Conservatively rated.



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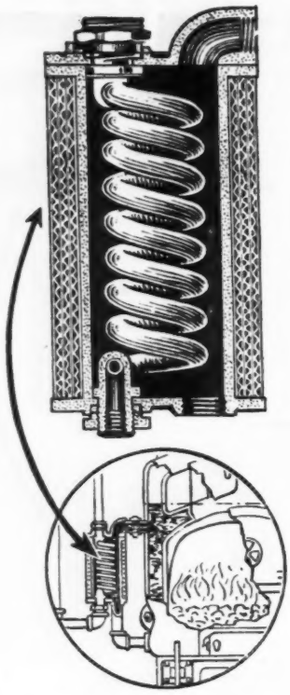

Sectional view of SURE HOT showing (in circle) how it is attached to outside of furnace.

SURE HOT WATER HEATER

Here is the very last word in domestic water heaters—a highly efficient heater that requires neither fuel nor attention once it is installed.

Attached to the outside of steam furnace, it provides a constant and abundant supply of hot water day and night. Boiling water from the furnace heats the coil in cast iron, asbestos covered shell. Eliminates leaky coils in fire box and old-fashioned water back.

The design and construction has been carefully worked out by Whitlock Engineers to whom you need no introduction. For more than thirty years the name WHITLOCK has stood for the highest engineering skill plus the best equipment it has been possible to produce.

Specify and insist on the GENUINE Whitlock SURE HOT.

Write for literature, prices and discounts.

THE WHITLOCK COIL PIPE CO., Hartford, Conn.

World's Largest Manufacturers of Service Water Heaters

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Distributors of "NATIONAL" STEEL PIPE

"BYERS" GENUINE IRON PIPE

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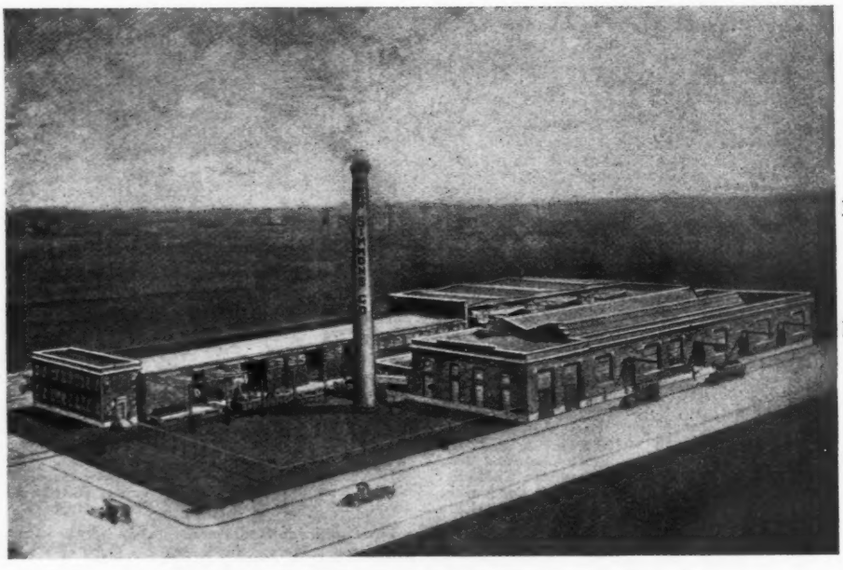

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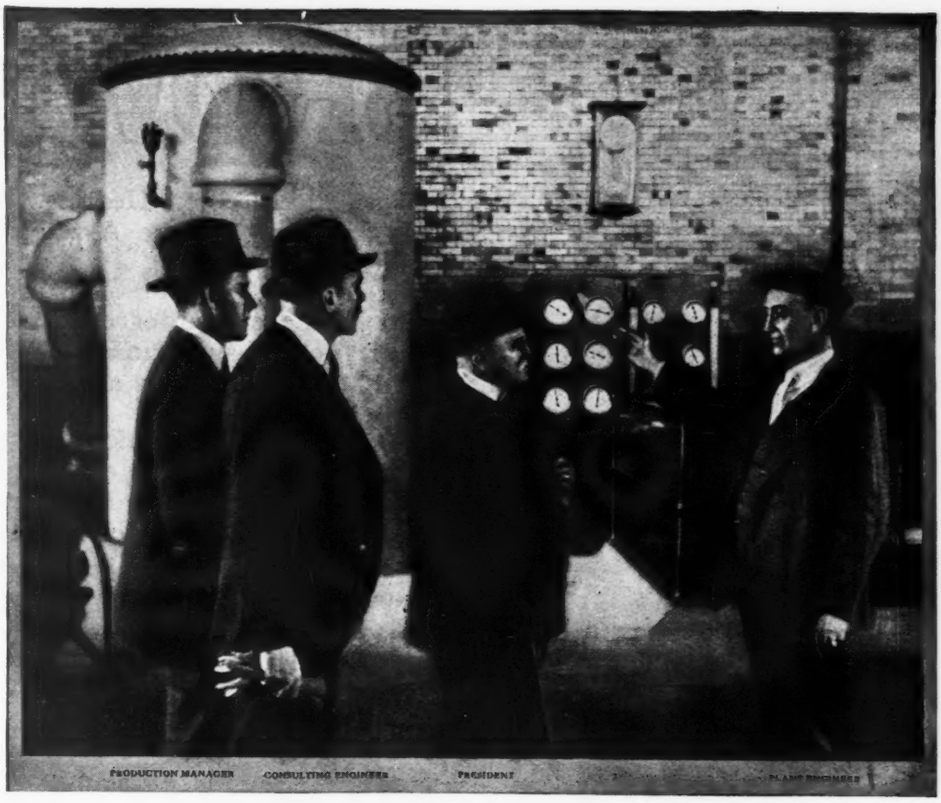
Dramatized Facts out of The Day's Work

No. 13

The next day they stood in the engine room of the great South Works of the J. I. Case Threshing Machine Company.

"The temperature outside is 29 degrees," said the Plant Engineer, "and you see—" pointing to the control board, "my outgoing hot water is 140 degrees. After traveling through over a mile of welded mains, through thirty miles of heating coils, and through 75,000 square feet of cast iron radiation, the water comes back to me at 123 degrees."



And competitors thought they were losing money

"Nine hundred automobile dealers are expecting a night letter from me saying the price of our car has been cut 10%," said the President, fixing the Consulting Engineer with his steel-gray eyes.

"We've shown you a 7% saving without counting increased labor efficiency," came back the Production Manager.

"So far, so good; the only other idea you propose is to remodel the old heating system," snapped the President. "I'll grant you half the coal saving you claim, but what does it amount to per car?"

"I'm talking increased labor output, not coal savings—"

"Output, fiddlesticks; it's only on a few zero days that the plant is really uncomfortable.

"That's where so many manufacturers miss a bet," replied the Consulting Engineer. "They think workmen are only affected when their fingers are numb with cold."

Like a flash the Production Manager cut in with: "There's just one right temperature at which labor unconsciously and without effort works at top speed."

"Oh, I know all that," said the President testily, "but an automobile plant isn't a hospital. Keeping acres of plant space always at the right temperature is a pipe dream!"

Consulting Engineer: "Come up to Racine with me tonight and I'll show you a heating system that's a *dream* of piping."

* * * *

The next day they stood in the engine room of the great South Works of the J. I. Case Threshing Machine Company, illustrated above.

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Buzz! Buzz! Buzz! An impolite telephone interrupted him. He answered, then paused to turn a valve slightly.

"Somebody kicking for more heat, eh?" quizzed the visiting President with a sly wink at the others.

"Oh no," was the quiet reply. "That was just our regular half-hour report from the Weather Bureau. It's three degrees colder outside than it was at ten o'clock. I just turned in enough exhaust steam to meet that drop—"

"Exhaust steam!" exclaimed the President. "That means heat for nothing. Had I known our proposed system would utilize exhaust steam, I would have granted the enormous coal saving claimed.

"One question more, about the control and the workman's efficiency: Isn't there something peculiar to this plant that makes so remarkable a showing?"

"No," replied the Consulting Engineer. "The working of the system is due to the exactness of the engineering, the excellence of the construction work, and the intelligence of the operating engineer. Take *my* word on the calculations and the Grinnell Company's guaranty of performance."

* * * *

Send for our booklet, "Five Factors in Heating Costs." Address Grinnell Co., Inc., 280 W. Exchange St., Providence, R. I.

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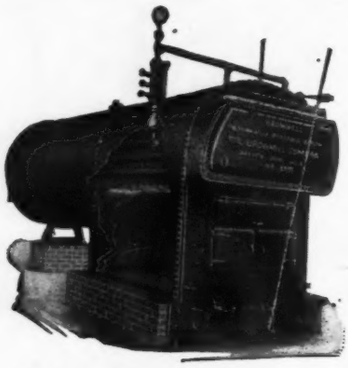
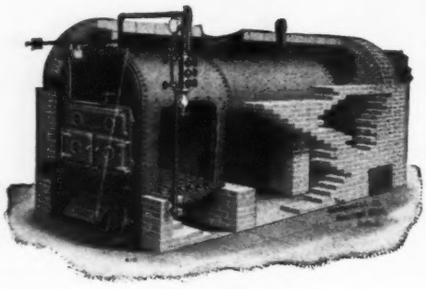
If it's Industrial Piping, take it up with us



Brownell Return Flue Portable Fire Box Heating Boiler--Direct Draft Type. Also made in Down Draft Type.



Brownell Brickset Fire Box Heating Boiler-- Direct Draft Type. Also made in Down Draft Type.

BROWNELL

Brownell Firebox Heating Boilers are regularly built according to the A. S. M. E. code for 15 lbs. working pressure.

They are designed for efficient operation and economical fuel consumption. The heating surfaces are liberal. Brownell boilers are very conservatively rated.

There is no economical substitute for Brownell quality. The more your experience, the more you will realize that this is true. Furthermore, Brownell prices are in line with the new conditions.

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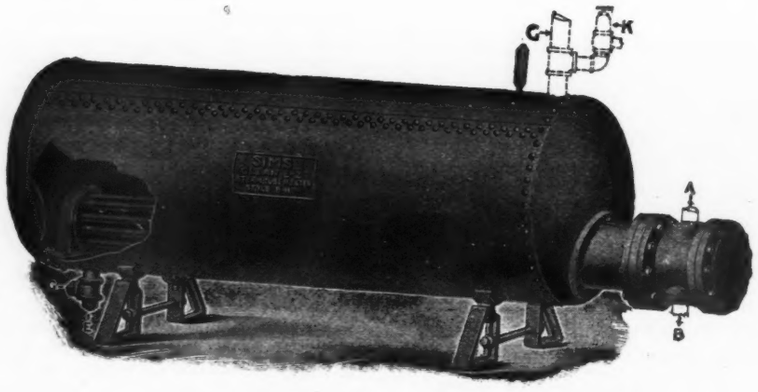
Established 1855

FIRE BOX HEATING BOILERS

Meet that Peak Demand for Hot Water

WITH A

Sims Clean E-Z Steam Tube Heater



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Especially Designed for Supplying Large Quantities of Hot Water

Send for tables showing heat capacities using steam at various pressures

"We keep others in hot water"

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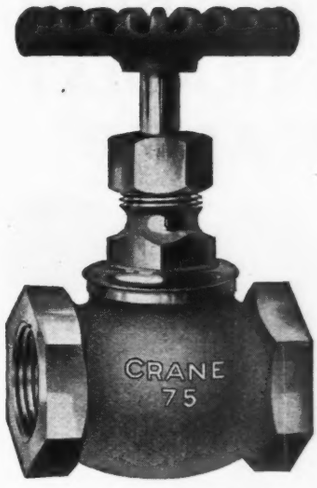
Brass Valves

For 75 Pounds Pressure



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Globe

Angle

Check

NO. 20B CHECK

NO. 2B ANGLE

THE increased use of piping material in homes, small factories, farms, garages, and water systems where the pressure does not exceed 75 pounds has created a demand for these valves. They may be repacked while under pressure when the valve is fully opened.

We are manufacturers of about 20,000 articles, including valves, pipe fittings and steam specialties, made of brass, iron, ferro steel, cast steel and forged steel, in all sizes, for all pressures and all purposes and are distributors through the trade of pipe, heating and plumbing materials.

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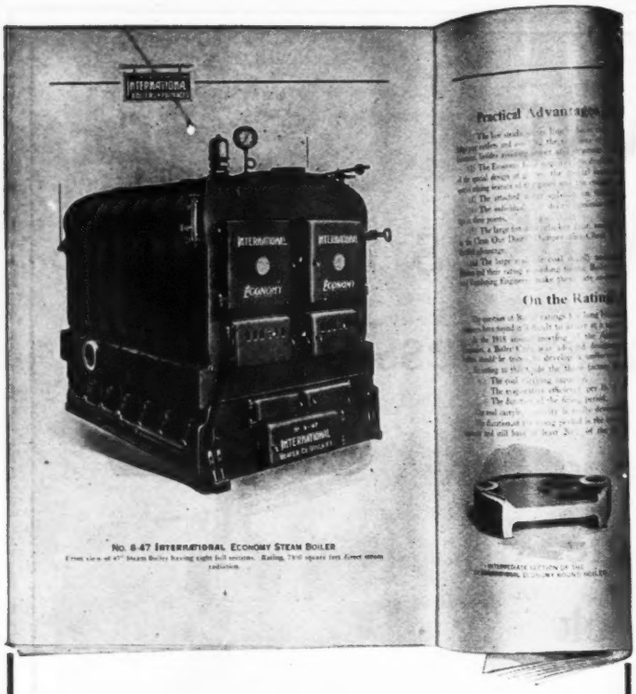

Do you have these Problems to Solve?

What conditions determine the style and size of boiler to install?

What percentage over the actual amount of radiation should be allowed as a factor of safety for boiler capacity?

What is the minimum chimney flue size and height recommended for any make of Low Pressure Boilers?

What fundamental conditions are necessary to insure successful installation?

How to suit the boiler to the job?

How to select a boiler for a poor chimney?

How to choose the right style of boiler when soft coal is to be used?

Answers to these questions and many others are given in our new *Economy Boiler catalog D-1296*. Every heating Contractor, architect and engineer should have a copy. Write today for your free copy and secure some real help on "suiting the boiler to the job."

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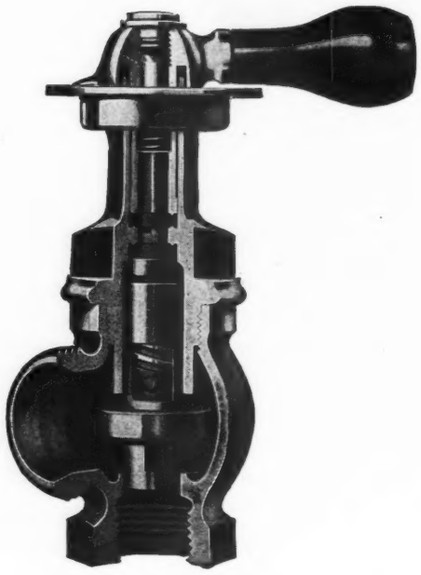
LAVIGNE PACKLESS QUICK-OPENING STEAM RADIATOR VALVE



Sectional View
Lavigne
Graduated Packless Valve

Made of the highest grade materials for rugged service.

Six sizes, many styles of handles

All good jobbers handle them

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At Last!

A SINGLE PIPE VAPOR SYSTEM

Simple to install
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Hot or Cold Wet or Dry

Heating Plant in the Winter—Cooling Plant in the Summer

Complete and Economical Temperature and Humidity Control System as well as a Complete Ventilation System the Year Around

THIS is, in a few words, what the Sturtevant-Fleisher Air Conditioning System does for the plant in which it is installed.

It is an economical system to operate, and the results of Ideal Climatic Conditions are well-known to every operating man. With a Sturtevant-Fleisher Air Conditioning Installation goes Guaranteed Ideal Working Weather conditions inside your plant every hour in the day—every day in the year, regardless of weather conditions outside.

A guarantee of this character, based on our 60 years' manufacturing and engineering experience is a Real Guarantee.

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PUTS AIR TO WORK

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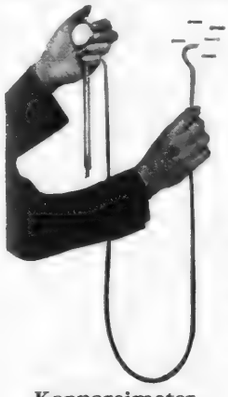
of accuracy, individuality and utility. It is found only on Air Test instruments that have been given the necessary thought and care to make them eminently suitable and convenient for the purposes for which they are intended.

We offer at the present the following interesting additions to the equipment of the Heating and Ventilating Engineer.



Kopnareimeter in Use

The Kopnareimeter (Smoke-air Meter)

With this instrument, it is possible for the first time to measure with accuracy and convenience air velocities from 5 feet per minute to 2500 feet per minute or higher.

It consists of a carefully calibrated glass tube, connected to a special nozzle by suitable rubber tubing. In using the instrument, the glass tube is filled with smoke from your cigar or cigarette, and the nozzle held in the air flow. The smoke column descends—with a clear line of demarcation between it and the entering air. The time in seconds, taken preferably by means of a stop watch, gives the velocity in feet per minute. Accuracy guaranteed, can be carried in the vest pocket. Price in leather case complete, **$16.50.**

Kopnareimeter and Whirling Psychrometer in Vest Pocket

The Cotometer

An accurate, portable and extremely simple device for determining the CO_2 content of the air, without the usual laboratory manipulations.

Price complete, in leather carrying case, with reagents for making 20 complete analyses, **$45.00.**

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The Whirling Psychrometer

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A marked improvement in Psychrometer design. The chain has been eliminated. The thermometers are attached to the handle by means of a rigid metal bar, which carries them in a constant plane when the instrument is whirled. Making the instrument more convenient than the old styles and reducing the thermometer breakage to the minimum. When not in use, the handle serves as a carrying case and the bar as a pocket clip.

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The Complete Air Test Case

has been enlarged, improved and several new instruments added. It is now recognized by most of the leading Universities and Colleges of Engineering as a necessary part of their teaching equipment.

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Price complete, **$175.00**, f. o. b., Chicago.

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It is now in the fourth edition. Price, **$7.50.**

The Psychrobook

NOTE: We have just received a foreign shipment of one gross of extra fine 10-inch mercury thermometers graduated from 20 to 120 Fahrenheit in 1 graduations. These are especially fine and accurate and ordinarily sell from $3.50 to $4.00 each. Our price while they last is $2.50, or $2.00 each in lots of six or more.

Send for a copy of our easy reading Psychrometric and Comfort Chart. Free for the asking.

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"O-E Perfect Packless Graduated Valve. Placed at top of Radiator. Quick opening. Never sticks. Tested by Air and Water tests.

Simplicity in a Heating System Is Twin Brother to Common Sense

The basic principle of the "O-E" Perfect Vapor-Vacuum-Pressure Heating System is simplicity. There are no floats, return traps, pumps, diaphragms or other complicated parts to get out of order. Eliminates automatic air valves.

Three Systems in One

Vacuum most of the time, Vapor part of the time, Pressure when desired. A great coal-saver. Always holds steady water line. Most adaptable, flexible and efficient of any. Noiseless in operation. Practically fool-proof, No expert attention needed.

"O-E" Perfect Air Exhauster and Vacuum Valve, with new Hollow Bronze Ball. Always works. Never sticks. Carefully tested.

The "O-E" System costs less to install and gives your customer better service than either vapor or water. Is easier to install right than wrong.

Before deciding on the heating equipment for your next job, investigate the "O-E" Perfect System. It will save you labor and material costs, unprofitable call-backs for adjustments and repairs, and our guarantee furnished with each installation fully protects you

"O-E" Perfect Ball Check Water Seal Return Fitting, with Air Vent and Clean Out. Each Fitting carefully tested.

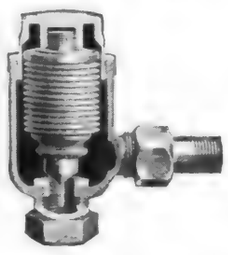
Write for Booklet "A"

O-E SPECIALITY MANUFACTURING CO.

882 THIRD ST., MILWAUKEE, WIS., U. S. A.

QUALITY SERVICE QUALITY

Heating Specialties that Last

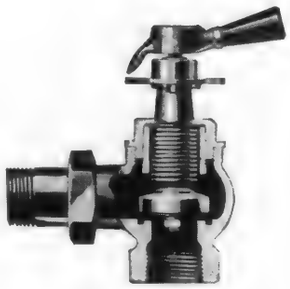


The B & B Line

In specifying the B. & B. Line of Heating Specialties for vacuum systems and Temperature Control Systems you are assured of getting QUALITY-SERVICE and a Heating Specialty that will last.

The B. & B. Multiflex Trap and B. & B. Multiflex Modulation Valve, as illustrated, are metal throughout and contain a B. & B. Multiflex Wonder Bellows. Note the simplicity in construction of the Multiflex Modulation Valve.

Literature sent upon request.



B. & B. Vacu-Vapor System

B. & B. Return Line System

B. & B. Air Line System

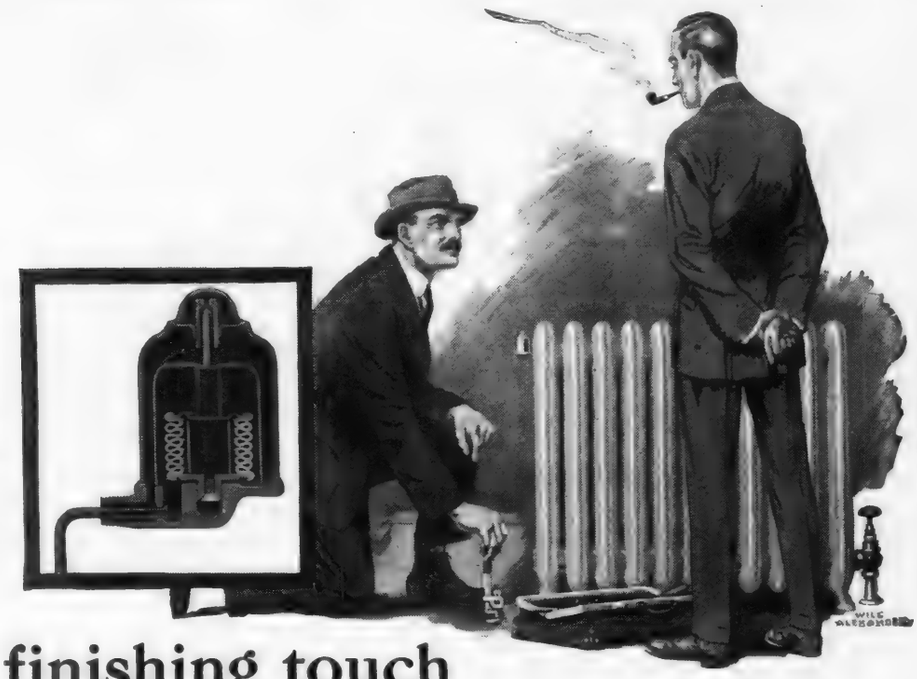
B. & B. Temperature Control System

B. & B. High Pressure Specialties

THE BISHOP & BABCOCK COMPANY

General Offices and Factories, CLEVELAND, OHIO

The largest plant in the world devoted to the manufacture of thermostatic instruments



Cross section, Sylphon Radiator Air Valve No. 536. (Illustration ½ actual size.)

That's the finishing touch to a workmanlike job

"YOU'VE given me a fine heating plant, Dawson," the appreciative owner commented. "I left everything to your judgment and I'm glad I did. What kind of air valves are those you're putting on?"

"These are Sylphons, the best air valves I ever tried," the Heating Contractor responded. "Each valve contains a Sylphon, or drawn metal bellows, filled with a volatile liquid. When steam enters the valve, this liquid volatizes instantly, closing the valve tight against the escape of steam.

"When air enters the valve the Sylphon contracts, leaving the valve wide open. That is because of the unusually long stroke of the Sylphon. It means quick venting and the absence of any hissing due to a partially closed valve. A large area float prevents the escape of any water."

"Well," said the owner, "that is the finishing touch to a workmanlike job."

And the Heating Contractor said to himself, "They *do* notice the important little things that make a good job better. First, he was pleased with the Sylphon Leakless Valves, then he noticed the Sylphon All-Metal Diaphragm Damper Regulator, and now it's these 536 Air Valves. It sure pays to be up-to-date."

The Heart of Sylphon Products

This is the wonderful Sylphon diaphragm or bellows which operates Sylphon Radiator Air Valves. Filled with a volatile liquid which expands or contracts with the slightest change in temperature. Made of one continuous piece of drawn metal, the Sylphon diaphragm or bellows has extreme flexibility combined with the greatest possible strength. No solder to leak or crack. The Sylphon diaphragm or bellows was invented and patented by W. M. Fulton and is found only in genuine Sylphon instruments.

THE FULTON COMPANY, Knoxville, Tenn.

New York
Hudson Terminal Bldg.
50 Church St.

Detroit
Book Bldg.
Washington Blvd.

Chicago
Wrigley Bldg.
400 N. Michigan Ave.

Representatives in all the larger centers

Sylphon
Heating Specialties

THE FULTON CO., DEPT. W, Knoxville, Tenn.

Check here if you wish information on other Sylphon products.

☐ Temperature Regulators
☐ Damper Regulators
☐ Leakless Radiator Valves
☐ Pressure Regulators

Please send me full particulars of Sylphon Radiator Air Valves, without obligation.

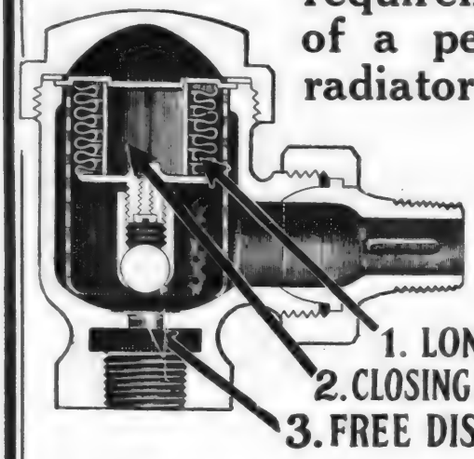
.....

.....

Radiator Trap

SARCO

Meets the 3 requirements of a perfect radiator trap



THE value of a trap is determined by its performance with respect to the three requirements named above. In this "acid test" the Radiator Trap Sarco proves its superiority over all others.

The life of the expansion element in the Sarco exceeds many times the life of any other element due to the spiral corrugations which distribute the stress of contraction and expansion over the entire surface, eliminating unequal distribution of movement which is inevitable in elements made with annular corrugations.

Maximum closing pressure is obtained through the vaporization of the special volatile fluid which forces the ball valve against the valve seat with positive pressure, insuring a tight valve.

Free discharge is obtained through an orifice of unusually large diameter, and by the upward movement of the valve ball, under the contracting power of vacuum within the element.

For vacuum, vapor and steam heating systems at pressures up to 20 pounds.

Write for Booklet P-102 which describes other Sarco features.

Sarco Co., Inc.

231 Broadway, New York City

Buffalo Chicago Cleveland Detroit Philadelphia

CONNERSVILLE Vacuum Cleaners

State & Lake Theatre
Chicago

C. W. & Geo. L. Rapp
and
C. A. Lonsburg,
Assoc.
Architect, Chicago.

W. B. Tubby, Archt.,
New York.

East Ohio Gas Co.,
Cleveland, O.

In these Modern Buildings— there is Absolute Cleanliness

When the builders and designers of such palatial and beautiful buildings as these, adopt the CONNERSVILLE vacuum cleaning system to keep their buildings clean and healthful—there must be a strong reason for their choice.

CONNERSVILLE VACUUM CLEANERS stand the test, and please the most scrupulous and particular building owners and managers.

Whether it is the cleaning of luxurious carpets and hangings of the theatre, or the hardwood floors of the office building—the CONNERSVILLE VACUUM CLEANER is ideally designed to do the work thoroughly and economically.

Direct discharging of all refuse to the sewer is an important CONNERSVILLE feature. CONNORSVILLE cleaners are always ready for action.

YOU'LL FIND CONNERSVILLE REPRESENTATIVES IN MOST IMPORTANT CITIES.

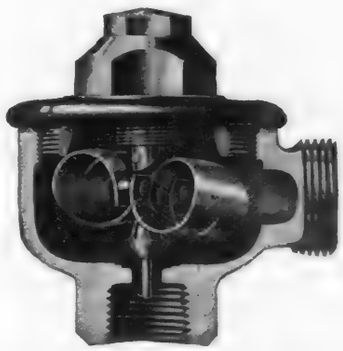
DEPARTMENT "C"

Manufactured by

LANDERS, FRARY & CLARK

United Vacuum Appliance Div.
Connersville, Indiana

The Trap, the Man, and the Letter



This Trane Thermetal Radiator Trap — reproduced here with body in section to show thermostatic member— is the one used by Professor Gebhardt for his test. Note that it has *no* diaphragm— there are no liquids to leak or give out! The Trane Trap is all metal.

Its permanency, dependability, and precise reaction to temperature changes have long been established. This report is but one more of the many proofs we have for making such a statement. If you're interested we shall be glad to give you others.

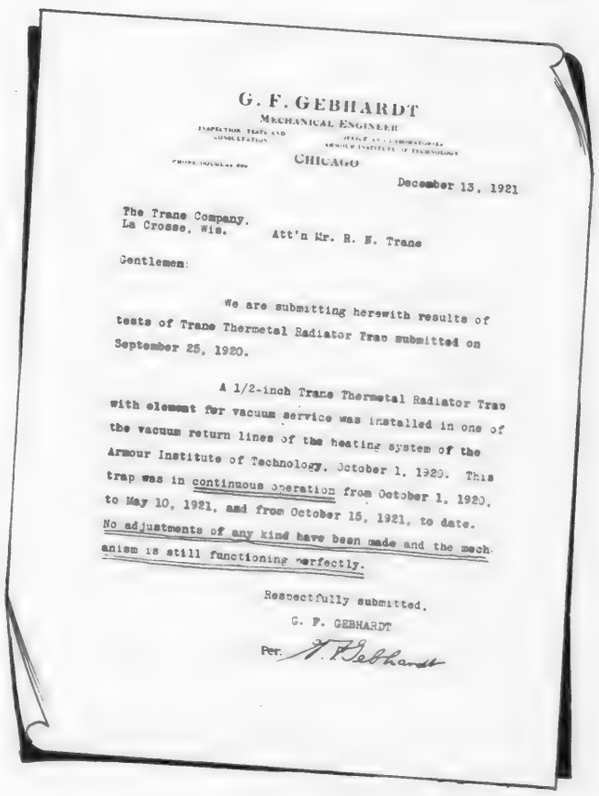
And, by the way, the Trane Float Vent Valve and the Trane Quick Vent Valve use this same engineering principle—no diaphragm. They are designed to eliminate air from the heating system, be it steam, vapor, or vacuum.

How modern engineering methods have replaced fragile diaphragms with everlasting metal makes an interesting story. It's told in our Bulletins 6 and 12.

Your queries will be welcomed. Write now.

G. F. GEBHARDT, M E., has been a teacher of Mechanical Engineering at Armour Institute of Technology for about twenty years. During that period he has specialized on research, consulting, and testing work. A biography printed in Power, on June 22, 1920, describes him as being "a genius for devising mechanical means for laboratory testing." His decisions are absolutely authoritative; the Professor is frequently selected as the mechanical expert in court action. He has made numerous contributions to the technical press, and is the author of "Steam Power Plant Engineering," a text that has passed through many editions.

When Professor Gebhardt tests a radiator trap for a year and reports that "no adjustments were necessary and the trap is still functioning perfectly," there is nothing in line of praise that remains to be said. Read the report below.



G. F. GEBHARDT
MECHANICAL ENGINEER
INSPECTION, TESTS AND CONSULTATION
CHICAGO

December 13, 1921

The Trane Company,
La Crosse, Wis.
Att'n Mr. R. H. Trane

Gentlemen:

We are submitting herewith results of tests of Trane Thermetal Radiator Trap submitted on September 25, 1920.

A 1/2-inch Trane Thermetal Radiator Trap with element for vacuum service was installed in one of the vacuum return lines of the heating system of the Armour Institute of Technology, October 1, 1920. This trap was in continuous operation from October 1, 1920, to May 10, 1921, and from October 15, 1921, to date. No adjustments of any kind have been made and the mechanism is still functioning perfectly.

Respectfully submitted,
G. F. GEBHARDT
Per. F. Gebhardt

The Trane Company, 206 Cameron Ave., La Crosse, Wis.

Chicago New York Boston Philadelphia Washington, D. C. Cleveland Buffalo Salt Lake City Seattle Portland, Ore.

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THE MOUAT
Vapor Heating System

Complete circulation at a pressure of 1¾ ounces

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Cleveland, Ohio

VAPOR MOUAT HEAT

In educational institutions—

State Normal School, Marquette Michigan Webster Equipped

as in every other type of building, Webster Systems of Steam Heating are pre-eminent

The satisfactory manner in which Webster Systems of Steam Heating meet the heating system requirements of educational institutions is indicated by the hundreds of school and college buildings in which they assure a comfortable, readily adjustable and economical warmth.

Webster Steam Heating Systems have proven equally successful in every other type of building, as is being demonstrated in over 17,000 installations.

Let the Webster engineers help you plan your next installation. 90

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MODULATION SYSTEM OF STEAM HEATING
VACUUM SYSTEM OF STEAM HEATING
STEAM AND OIL SEPARATORS
FEED WATER HEATERS
STEAM SPECIALTIES

"Well Andy

You get the Heating Contract"

"Yes, Sir, I'm Andy now, instead of Mr. Jones, to every member of the building committee. It just shows how they warmed up to our proposition. The Chairman said, 'We give you the business, Andy, because, although your bid is not the lowest, we believe you give us the most for our money.'

"And he's dead right. We do give him the best heating service and the least trouble. I sold those fellows on a system scientifically designed to meet every requirement of their particular building, instead of talking technicalities.

"Then they asked about automatic traps, vacuum pumps, etc., to insure circulation.

"I sure got their interest when I said Moline Heat installation is designed so carefully that it needs none of these little troublesome helpers. It is a healthy system of steam circulation that needs no crutches.

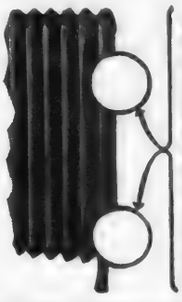
"That simplicity got 'em. They saw at once that they cut out grief when they cut out these jiggers. Furthermore, I guaranteed to heat every radiator at the same time, regardless of its location. This won them and we got the contract.

"And it's a cinch to make good with the Moline Heat scientific system of circulation and simple equipment. We know our profits right now—because we know we can't run against any snags or 'come-backs'."

There are thousands of Moline Heat Contractors landing big contracts with generous profits. The Moline Heat man doesn't have to underbid. He does't talk price—he does talk satisfactory heating service and low maintenance costs.

It's easier to sell Moline Heat than compete against it. If you're looking forward to bigger, better, cleaner, more profitable business, get busy now.

Just you send the building plans of your next prospect and let us submit a proposition—and see what happens. The Herman Nelson Corporation, Dept. H2, Moline, Illinois.



MOLINE Heat Simple Equipment, combined with Moline Heat Scientific Method of Steam Circulation and Piping Design, eliminates the necessity of using Automatic Air Vents, Automatic Radiator Return Traps or Vacuum Pumps of Any Kind on 90% of all heating problems

Moline Heat
EVERYWHERE
TRADE MARK

To Secure Positive Heat Control Assures Fuel Economy

Adsco Heating accomplishes the two prime requisites of a heating system; comfort and economy. The positive control of the steam at each radiator by the Adsco Graduated Radiator Valve makes overheating unnecessary. As little or as much of the radiator's surface may be used as needed to heat the room comfortably. Saves 20% to 30% fuel costs. Vented to the atmosphere— o noise. Pressure maintained constant by Adsco Damper Regulator. Installation cost low because air valves, traps, vacuum pumps not needed. Adsco Heating specialties are used with all makes of boilers.

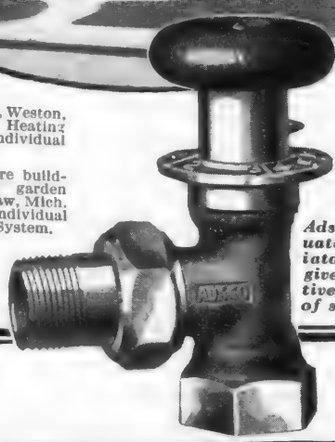
Write for Bulletin No. 159-H for technical data describing Adsco Heating; also tells how to change hot water systems. Ask for Bulletin No. 158-H for individual boiler installation; Bulletin 20-H on Adsco Community Heating of building groups from Central Station Steam Plant.

AMERICAN DISTRICT STEAM COMPANY
GENERAL OFFICES AND WORKS
NORTH TONAWANDA N.Y

First National Bank Bldg. Chicago | 1544 Woolworth Bldg. New York | Hoge Bldg. Seattle | 1404 Arrott Bldg., Pittsburgh, Pa

Masonic Temple, Weston, W. Va. Adsco Heating is used with individual boiler plant.

Group of six store buildings with roof garden overhead, Saginaw, Mich. Each has its individual Adsco Heating System.



Adsco Graduated Radiator Valve gives positive control of steam.

ADSCO HEATING

A Super-Regulator for Vapor Heating Work

POWER IS ITS MIDDLE NAME

Draft dampers are controlled with strong and steady graduated movement, accurately responsive to slightest change in boiler pressure, even to the fraction of an ounce.

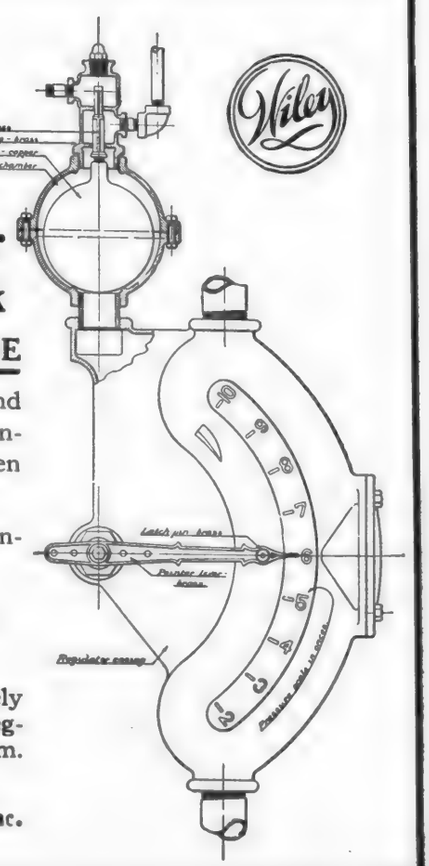
A vapor or modulating system has a new meaning when hooked to the boiler with a

Wiley Safety Vent Vapor Regulator
built for lifetime service

All working parts of cast bronze, accurately machined. Safety-Vent-Valve forms part of regulator and handles air from entire heating system.

Write for prices and full information

SIMPLEX HEATING SPECIALTY COMPANY, Inc.
LYNCHBURG, VA.



BE GUIDED BY THOSE WHO KNOW

Their Judgment Commands Respect

Endorsed and Sold by the following boiler manufacturers

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The Wm. H. Page Boiler Co.
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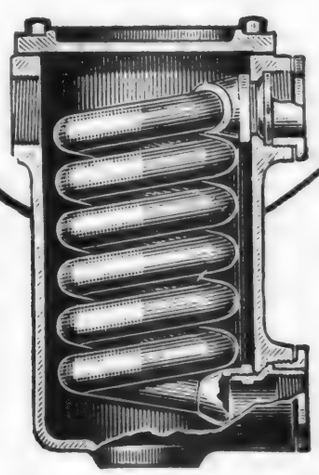
Thatcher Furnace Co.

Also by Plumbing Supply Jobbers Everywhere

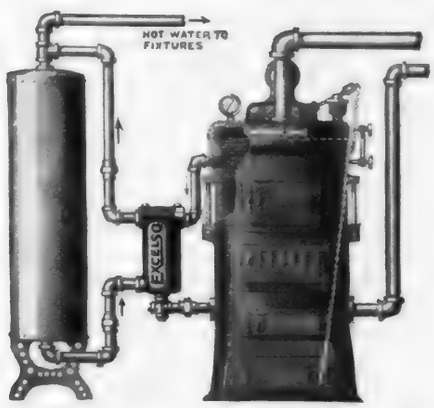
Their Judgment Has Been Vindicated by Thousands of Users



Sectional View of Heater

Sold on a Money Back Guarantee

Thousands In Use



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Does Away With Fire Pot Coils
Patented Ground Joints
Eliminating Leaks

Copper Coil containing domestic supply of household water is heated by boiling water from boiler.

Money Back Guarantee

Your clients will be more than pleased. Their satisfaction is a boost.

Write for details, prices, discounts, etc.

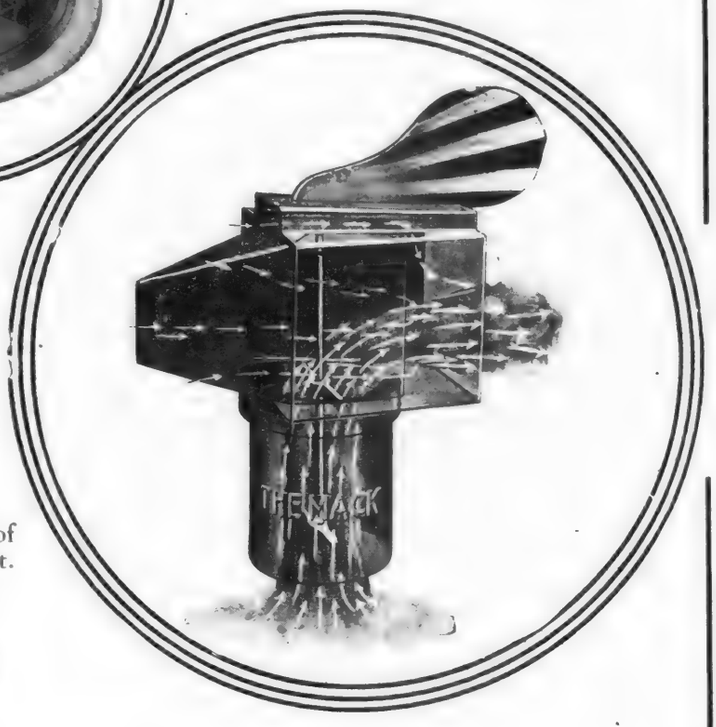
Excelso Specialty Works
117 Clinton Street, Buffalo, N. Y.

Special New York Sales Representative
JOHN G. KELLY, 137 E. 43rd Street

"All Good Things Are Three"

1. Airomatic. "A ventilator without a storm band, yet absolutely weather and down draft proof. Note generous openings. Ventilates in any wind, straight across, up or down. Rigidity assured. All edges are wired.

2. The Perfecto. A combined damper-lock, regulator and indicator. Regulates and controls incoming tempered air and exhaust of vitiated air. Locks that control. Indicates position of damper. Designates rooms to which ducts are directed. Made of stamped steel, any desired finish.



3. Mack Ejector. "A ventilator that uses its head," always operative, utilizing low velocity wind pressure. Inverted bronze bushing working in steel bearing, and individual balancing, assure silent ease of motion and positively prevent down-draft. Substantially built and all edges are wired.

All 3 Are Good

Manufactured by

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Rex and Second Sts., S. E. **Canton, Ohio**

ALLEN AIR-TURBINE VENTILATOR

Standard of Ventilating Efficiency

Wherever ventilation is desired—in factories, foundries, stores, schools, hotels, churches, theatres, residences, kitchens, bakeries, tanneries, barns, stables, garages, chimneys, air shafts, or wherever air circulation is required, Allen Air-Turbines *have proven the best, cheapest and most efficient* ventilating system known.

Many of America's largest architects, engineers and industrial concerns have adopted and endorse Allen Air-Turbine Ventilators.

Patented

Our air displacement is measurable and the figures given are guaranteed to be correct.

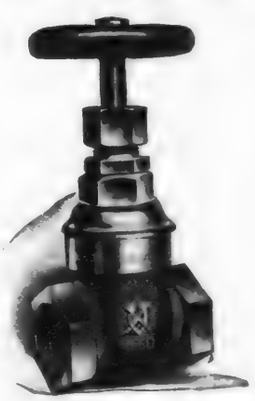
Diameter of Pipe	Air Displacement Cu. Ft. per Hour	
	Wind Velocity 4 Miles per Hour	Wind Velocity 8 Miles per Hour
8 Inches	17,300	21,600
10 "	26,500	32,500
12 "	38,600	46,200
15 "	54,000	69,000
18 "	85,200	102,100
20 "	105,100	125,600
24 "	149,000	185,000
30 "	225,000	272,000
36 "	281,000	330,000
42 "	324,000	414,000
48 "	360,000	473,000

CARRIES OFF
GASES
MOISTURE
STEAM
SMOKE
VAPOR
FOUL AIR
ODORS
HEAT
FUMES
DUST
DAMPNESS

Write for Detailed Literature

ALLEN AIR-TURBINE VENTILATOR CO.
DETROIT Eighth and Porter Sts. **MICHIGAN**

KENNEDY VALVES

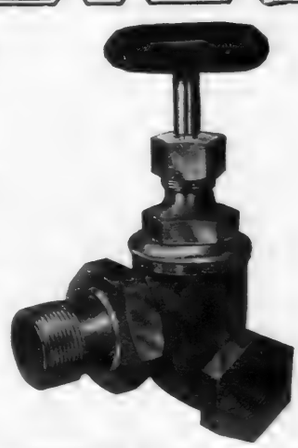


The Test of Valve Quality

is the length of time the valve continues to render the most efficient service without giving trouble or entailing expense. There are Kennedy Valves of the long time kind all over the United States and Canada.

These Kennedys are doing good work in every variety of valve service, and a considerable proportion of them are on high and low pressure heating system lines.

The experience of thousands of users of Kennedy Valves have given the Kennedy product a reputation for durability, reliability, and efficiency of which we are justifiably proud and that we conscientiously strive to maintain.



You can be sure that every Kennedy Valve you install will be *permanently* satisfactory in every way. The Kennedy Catalog explains the details of design and construction that assure easy operation, low repair cost, negligible attendance and unusual durability. Send for a copy and use it to help make a selection of Kennedy Valves for trial. 250

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Branch Offices and Warehouses
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SAN FRANCISCO: 23-25 Minna St.
BOSTON: 47 India St.
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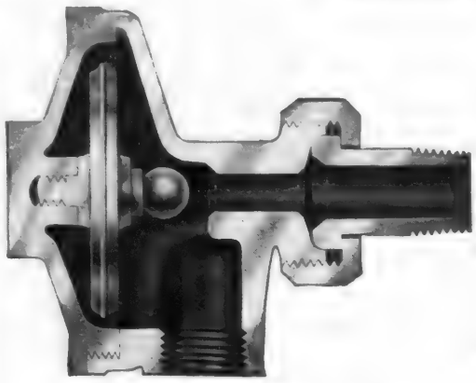
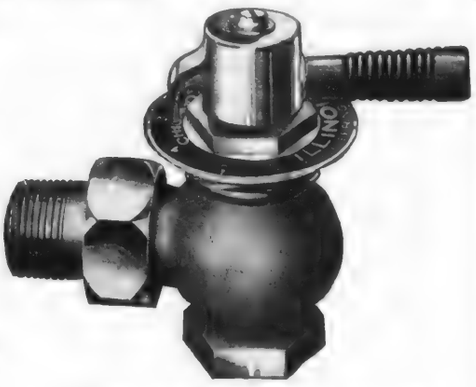
A RECORD OF 20 YEARS OF SUCCESS



SPECIFY
THESE
ILLINOIS VALVES
whenever you want the best

Write for New Vapor Catalog—real data



THERMO RADIATOR TRAP
The Original Vertical Seat Trap. Dirt proof. Closes against the steam. Positive operation and long life.

ILLINOIS MODULATING VALVE
A half turn from full open to closed. All working parts accurately machined. Easiest operating valve on market.

"Illinois Heating Systems make warm friends"

ILLINOIS · ENGINEERING · COMPANY

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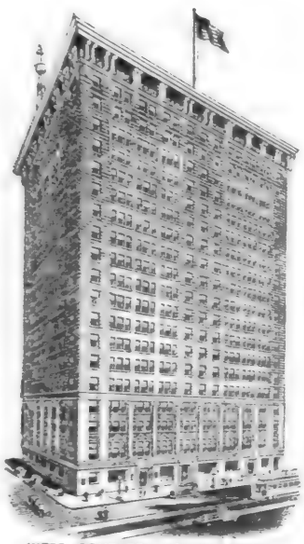
Representatives in 21 principal cities **Consult local telephone directory**



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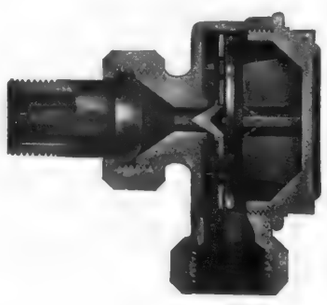
Louisville, Ky.
D. X. Murphy Bros., Archts.

·McALEAR·

Radiator Trap Efficiency

Holds true on any pressure from vacuum to 15 pounds discharging into either a vacuum or atmospheric return.

Inter-Southern Life Building is McAlear Equipped



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The McAlear Mfg. Co.

1901-07 S. Western Ave., Chicago
Representatives in all Principal Cities

The Heating and Ventilating Magazine

VOL. XIX. NO. 4

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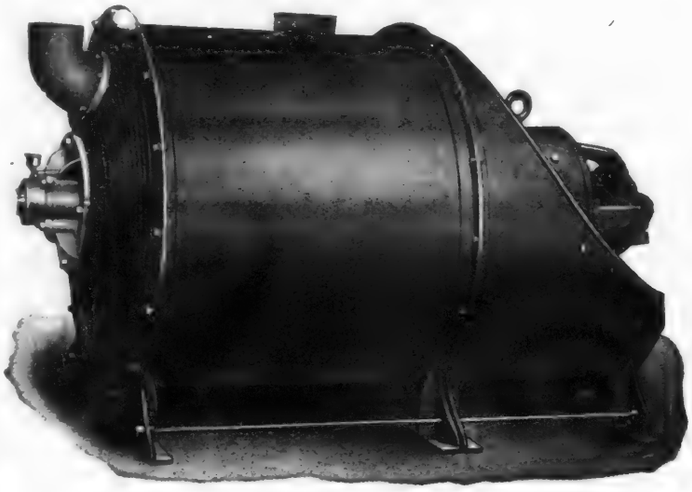

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A MONTHLY JOURNAL OF ENGINEERING PROGRESS

APRIL, 1922

WHERE WE ARE AT IN PRESENT-DAY VENTILATING PRACTICE

Comments on the Conditions Now Sought Through the Installation and Operation of Properly Designed Air Supply Systems

BY NELSON S. THOMPSON,

Chief Mechanical and Electrical Engineer, Office of Supervising Architect, U. S. Treasury Department.

EDITOR'S NOTE.—*It is well, perhaps, once in a while to come to an abrupt halt to consider where the new practices and theories regarding ventilation have brought us and to fix the new landmarks clearly in our minds. In the accompanying review of the situation, the author speaks with considerable authority since the Office of the Supervising Architect of the Treasury Department has full control of the design, construction and operation of the major number of Federal buildings erected under its supervision.*

THE writer's views on the subject of ventilation for schools and other public buildings come at a time when, as is well known, the whole matter is "up in the air." Our dear old former standards:

Uniform temperature, 68° to 70° F.
Freedom from dust and odors.
Uniform relative humidity, 43% approximately.
Low air velocity and no appreciable air movement in rooms, 30 cu. ft. per occupant per minute,

no longer seem to have full authority, especially the last, which was truly our sheet anchor to windward, but which, under a moderate gale of real investigation, has dragged so badly that now more than 6 parts of CO_2 in 10,000 are no longer a bugaboo, Dr. Vernon Hill, the late John R. Allen, Dr. Henderson of Yale and others here and abroad have laid the ghost of CO_2 as a real measuring stick in ventilation.

THE HUMIDITY STANDARD.

Dr. Henderson, Professor Sheppard and many other authorities are agreed that reasonably high humidity is of great importance. Dr. Henderson goes so far as to recommend 80%. The consensus of opinion seems to be that it should be kept as high as possible, say 45% to 50%, or at such point as will not cause deposit of moisture on windows and cold walls.

Unquestionably a high percentage of humidity permits the maintenance of a lower temperature in the room and greater movement of cooler air without discomfort than would be the case with drier air, say with 25% relative humidity, such as is found in the usual unventilated room with direct steam or water radiation during the major part of the heating season.

At this point it is pertinent to direct attention to the following statement, taken from a pamphlet issued by the Department of Health of the City of New York, No. 68, February 1918, by S. Josephine Baker, entitled "Classroom Ventilation and Respiratory Diseases among School Children:"

> "It was found in this investigation that the relative humidity of classrooms, whether ventilated by natural or mechanical means, was not a causative factor in the occurrence of respiratory illness in school children."

From a medical standpoint it may be absolutely certain that high humidity is desirable, but I think we all will agree that it should not be uniform; it should follow Nature and vary slightly from hour to hour.

IMPORTANCE OF REDUCING DUST.

Dust in the air is of fundamental importance from the standpoint of health, and in this connection everyone should read that celebrated volume, "Fragments of Science," where amidst much valuable information will be found John Tyndall's investigation of the subject of "Dust and Disease." Attention may also be directed to the last address of the late John R. Allen, bearing on the imperative necessity of removing so far as possible the dust from the air in order to prevent pneumonia and other strictly dust-borne diseases so fatal to older people. In connection with this subject, and also for its most able analysis of ship ventilation, the paper presented at the recent annual meeting of the American Society of Heating and Ventilating Engineers, in January of this year, by Dr. R. C. Holcomb, U. S. N., should be carefully read and digested.

EFFECT OF ODORS.

Odors are psychological. They must be reduced to a minimum or enirely eliminated if we are to have satisfactory ventilation. In this connection Dr. Vernon Hill's paper on this subject should be carefully read.

FALLACY OF LOW AIR VELOCITY AND UNIFORM TEMPERATURE.

In regard to air movement in rooms, supply and exit ducts, etc., the old idea of extremely low velocity and nearly stagnant air has been as fully exploded as the CO_2 fallacy.

The old standard of maintaining an absolutely uniform temperature of 70° F. in an apartment has also been fully exploded, and the tendency is now downward. With proper humidity a temperature as low as 65° is entirely satisfactory. Dr. Henderson has, I believe, convinced most people that uniformity of temperature and humidity is not desirable, but rather the reverse. As John R. Allen said: "we want the sudden changes in temperature and humidity which energize our skins." Allen further pertinently remarks in regard to temperature:

> "The most important function is the control of temperature in the body; there is no function more accurate in the human system than temperature control. If our temperature rises more than 4° or 5° they put us to bed; if it rises 8° or 10° they put us in a coffin."

ENERGY OF THE SOLAR BEAM THE FOUNDATION OF THE UNIVERSE.

I fully agree with Dr. Allen that temperature, humidity, and circulation are the three most important things in ventilation, and of these three temperature is of paramount importance. As I view Nature, temperature or rather heat—the energy of the solar beam—is the foundation of the universe.

I have very grave doubts as to the advisability of using ozone, notwithstanding the seemingly good results reported in connection with its use in the St. Louis schools. I feel that the highest grade of medical men, or, at least, highly-trained physicists, are alone competent to pass upon the introduction of chemicals into the air.

THE PALMER ARRAIGNMENT.

The severest arraignment of the prevailing methods of school ventilation has been made by George T. Palmer, Epidemiologist of the Detroit Department of Health, based on a study made by himself, together with Dr. S. Josephine Baker, chief of the Bureau of Child Hygiene, New York City Department of Health, in 1916-1917, acting jointly with the New York State Commission on Ventilation. He states, in part, as follows:

> "There appears to be something inherent in the indirect method of ventilating schoolrooms by means of forced draft and gravity exhaust, as practised in this study, that is productive of respiratory affections; something which is not present in rooms ventilated with windows and gravity exhaust."

A part of the harm he attributes to high temperature of the air, and another part to the uniformity of the temperature and the air flow. He tells us that the temperature of window-ventilated schoolrooms may be reduced to 59° F. without increasing the prevalence of colds. He admits that window ventilation is not entirely satisfactory, though it is more nearly so than mechanical ventilation. Respiratory sickness is greater in fan-ventilated rooms than in window-ventilated rooms, even though there is not more than one degree difference in temperature and the fan-ventilated rooms are more spacious. It is low temperature rather than chemical purity of the air which conveys the sensation of freshness, he states. He does not condemn alone, but advances the following:

> "For theaters, assemblies, and such large rooms and more uniform crowds there is no escape from mechanical ventilation.
>
> "In window ventilation there should be ample exhaust outlets and ducts placed on the inside walls with proper regard for the location of windows as well as their size. The radiators should be placed beneath the windows. Every window and other inlet should be provided with a deflector. If the teacher will maintain the temperature of the air in a scholroom somewhere between 64° and 70° F., changing the air constantly, but without strong drafts, it matters little what other standards are met. However, the air should be kept reasonably clean and sunlight should be given a chance to sterilize things."

In his judgment the conditions of the weather are more important in causing colds than is the ventilation of the schoolroom.

The writer's own observations bear out the foregoing. We find that the consensus of opinion among the teachers in our schools is that the standard fan blast type of heating apparatus, with automatic temperature control, is decidedly uncomfortable and unsatisfactory as far as they are concerned, and that they will do all they can to be detailed to a school, even one with direct radiation only, where they have full control over the temperature.

In this connection, especial attention is directed to an article by Dr. William E. Watt in "The Nation's Health" (Chicago), entitled "Process of Building up our National Resistance," in which he places great stress upon the evil effects of high temperature generally maintained in the "perfectly mechanically-ventilated schoolrooms," etc. He more or less excoriates the mechanical systems installed in late years by the average engineer as representing the last word in ventilation. He makes this pertinent statement:

> "The New York State Commission on Ventilation says that temperature between 68° and 75° induces a strain which adds 23 pulse beats per minute, while the body averages 1.5° above normal."

And further:

> "Few teachers—very few—are sound after 20 years in school air. Life insurance companies put teaching down as a hazardous occupation, next to saloon keeping and marble cutting."

OUTDOOR CONDITIONS DURING THE HEATING SEASON.

Before we proceed to discuss standards for the ventilation of schools and public buildings, let us ascertain what conditions Nature maintains during the heating season, and keep in mind that the temperature, humidity, and velocity of air, dust content, etc., vary each day from hour to hour. Let us consider the following table, giving careful attention to the broad averages shown. It would seem axiomatic that Nature has adapted us to meet conditions as they naturally exist. She has not had time to adapt us to the artificial conditions imposed by man.

Cities between Latitude 39° and 43° Longitude 71° and 125°	Temperature, Deg. F.			Relative Humidity, Per Cent.		
	Winter Mean	Spring Mean	Fall Mean	Winter Mean	Spring Mean	Fall Mean
Boston, Mass.	29	46	53	73	69	77
Buffalo, N. Y.	26	42	51	77	73	75
Albany, N. Y.	25	46	51	82	76	83
Ithaca, N. Y.	26	45	50	83	75	81
New York, N. Y.	32	49	55	75	72	78
New Haven, Conn.	30	46	53	74	74	76
Atlantic City, N. J.	34	47	56	82	81	83
Philadelphia, Pa.	34	51	57	76	70	77
Harrisburg, Pa.	31	51	54	76	70	79
Pittsburgh, Pa.	33	51	55	81	76	79
Baltimore, Md.	35	53	57	74	68	75
Washington, D. C.	35	53	57	76	73	80
Parkersburg, W. Va.	34	53	56	82	77	82
Columbus, Ohio	31	51	54	83	76	80
Toledo, Ohio	28	47	52	84	76	80
Cleveland, Ohio	28	46	52	79	76	77
Cincinnati, Ohio	34	54	57	80	73	78
Indianapolis, Ind.	31	52	53	81	73	78
Detroit, Mich.	26	46	51	84	76	81
Chicago, Ill.	26	46	52	84	77	77
Springfield, Ill.	29	52	55	80	76	79
Sioux City, Iowa	21	47	50	84	78	80
Des Moines, Iowa	23	49	52	81	77	79
Kansas City, Mo.	31	54	57	79	77	76
Omaha, Neb.	24	50	53	81	76	76
Lincoln, Neb.	25	50	54	82	78	77
Denver, Colo.	31	48	51	59	63	57
Cheyenne, Wyo.	27	42	46	60	67	59
Salt Lake City, Utah	31	50	52	75	60	56
Pocatello, Idaho	28	46	49	79	73	63
Carson City, Nevada	34	47	51	72	62	63
Eureka, Calif.	47	50	54	89	90	92
Average mean	30.0	48.8	53.1	78.3	73.7	76.0

General average of temperature of Winter, Spring, and Fall means, respectively, 30.0 plus 48.8 plus 53.1 divided by 3, equals 47.3° F.

General average of relative humidity of Winter, Spring, and Fall means, respectively, 78.3 plus 73.7 plus 76.0 divided by 3 equals 76.0%.

VARIATIONS IN DUST COUNTS.

The dust count undoubtedly varies materially, probably between wide limits on mild and windy days. It also varies widely in different localities, when such cities as Washington, Denver, etc., are compared with Pittsburgh, Cincinnati, Louisville, Chicago, etc. Dr. R. C. Holcomb has the following to say on this subject:

> "City air is rich in dust. According to Aitken there are between 300 and 3,000 dust particles in a cubic centimeter of country air about Argyllshire, whereas that of London was found to contain between 48,000 and 150,000 in the same volume. In this connection it should be borne in mind that though dust forms a vehicle for bacteria, dusty air is sometimes comparatively free from bacteria. Ash cart men, for instance, from investigations in New York City, appear to suffer less from bronchial affections than one would at first imagine, but ash dust is sterile."

In regard to bacteria in the air of cities he states as follows:

> "The dust of city streets, contaminated by sputum of diseased human beings and the discharges of animals, has been investigated again and again, and perhaps needs no extended comment. Prudden in 1890 showed that the amount of bacteria in the dust clouds of ill-swept cities is startling. After five-minutes exposure of the 3¼-in. culture plate, clean dust gave 10 to 35 colonies to the liter. Blowing dust gave from 214 to 941; and following the street cleaner gave 5,810 colonies to the liter."

And again:

> "It should be understood that all bacteria upon dust do not come from the streets and the outside air. Since Eberth, in 1875, demonstrated the presence of various bacteria in normal perspiration and described the colonies which they form on hairs, a number of investigators have interested themselves in bacteria and moulds of the surface of the body, and as a result have discovered a profusion of organisms. . . . Based upon the investigation of the bacteria of the skin was evolved the present surgical technic of skin preparation of the patient and the surgeon before operation."

It should be borne in mind that only those bacteria which can resist long periods of drying, like the bacillus of tuberculosis, are of first importance. Further, Nature has for many centuries labored more or less successfully to protect the human mechanism from dust and bacteria.

AIR SHOULD NOT BE HEATED ABOVE 100° F.

The late Alfred Wolff made a statement some years ago which should not be forgotten, to the effect that under no circumstances should air be heated in excess of 100° F.

The writer feels that no medium used to heat air should ever have a temperature in excess of 100° F.; but it is realized that the cost of attaining this ideal is prohibitive.

We should remember that the studies of Mr. Fred R. Still led him to report that in the part of the United States covered by the foregoing table, for approximately 83% of the time during the heating season the outside temperature is 35° F.

INFLUENCE OF HIGH FIRST COST AND OPERATING COST.

We should also keep fully in mind the economic and financial sides of the problem; i. e., first cost and operating cost, and remember that both of these costs are constantly rising. With present cost of material, labor, fuel, etc., the taxpayer is making some drastic inquiries into the matter of ventilation of schools and public buildings, and is entirely within his rights in doing so. With the old style fan-blast system of heating and ventilating, in the majority of cases many of the teachers and all of the taxpayers were certainly not satisfied. How the children felt this deponent sayeth not.

MOST OF THE MECHANICAL HEATING AND VENTILATING SYSTEMS INSTALLED IN CITIES.

Let us further consider that practically all of our heating and ventilating apparatus is installed in schools located in the larger cities where dust exists in the atmosphere more or less continually, and where the pupils are in the classroom only about 850 hours out of the total of, say, 6,000 hours in the school year. Further, fully 50% of the pupils, some from very poor families, are of a low order of intelligence (some never took a bath in their lives). The balance live in homes heated by stoves, latrobes, and furnaces, with possibly 10% in homes heated by water or steam.

COMPARISON OF AVERAGE CONDITIONS IN HOMES AND IN SCHOOLROOMS.

No attempt is made in any of the homes to wash or filter the air or control the humidity, and very little attempt is made to control the temperature. When the children and teachers are not in their homes or at school they are subjected to the conditions prevailing outdoors, where humidity, temperature, air velocity, and dust content are controlled by Nature and certainly do not approximate the conditions we have attempted to maintain in our schools and public buildings. The writer considers it most pertinent to ask why we should spend money and effort in attempting to produce theoretically perfect conditions for about 15% of the school life of the child, while for the balance of the school year and for the entire non-heating season the pupil is left to the tender mercies of Nature or to the conditions provided by its parents. The whole idea is to the writer on a par with the now thoroughly exploded practice of providing sterilized drinking water for the pupils for the five hours they are in the schoolroom, while for the remaining nineteen hours of the school day and the entire time during vacation they must drink water from the faucets in their homes, without any attempt being made by 99% of the parents to boil or otherwise sterilize the water. The pure water only serves under these conditions to weaken the resistance of the child to disease. The French Navy at one time provided sterilized water in its fleets for all sailors, who upon arrival in port drank what pleased them, with the consequence that the navy was, it is said, decimated by diseases due to impure water.

The writer has dwelt thus long upon elementary principles because they are of the first importance, and it is the temptation of this age of unhealthy cramming to neglect them.

THE LARSEN TESTS WITH RECIRCULATED AIR PASSING THROUGH AN AIR WASHER.

After a full consideration of the foregoing let us see if we can raise our minds to clearness and establish at least one or more tentative standards, which preferably should be expressed numerically. In this connection let us give our attention first to the able investigations of Professor G. L. Larsen, associate professor of gas and steam engineering in the University of Wisconsin, conducted on school rooms in actual use (see Journal, American Society of Heating and Ventilating Engineers, October 1915, Vol. 22, No. 1). These point the way to a new standard, using recirculated air in combination with an air washer, without any provision at all for admixture of outside air. Professor Larsen's investigations show that satisfactory ventilation is obtained by recirculating only 15 cu. ft. of air per minute per occupant, provided it enters the rooms carrying the proper amount of moisture and at fairly high velocity. With this amount of recirculation he found that the CO_2 averaged approximately 13 parts in 10,000. He further found that as high as 20 parts of CO_2 in 10,000 do not have a sensibly bad

effect on ventilation. Using recirculated air under the conditions noted, he found that with a relative humidity of 50% to 75% a temperature of 65° F. or less is perfectly comfortable; and he further found that with 60% humidity, air may enter the rooms at 60° F. without creating discomfort. He reports no trouble with condensation on the walls and windows with this high humidity, although the outside temperature recorded during the tests averaged around 30° F.

SUGGESTED STANDARD FOR SUPPLYING WASHED RECIRCULATED AIR.

The conclusions of Professor Larsen are, we believe, sufficient to establish with confidence a standard for guidance when washed air is recirculated without the addition of any outside air, and we quote them as follows

1. The tests show that it is both unnecessary and uneconomical to supply large volumes of air to obtain good ventilation.
2. That 15 cu. ft. per student would be ample, providing it enters the room at a fairly high velocity and carries the proper amount of moisture.
3. With humidity ranging from 50% to 70%, the occupants of the room are perfectly comfortable at a temperature of 65° or even less.
4. With humidity of about 60%, the air can enter the rooms at a temperature of 60° without creating any discomfort; in fact it seems to give life to the air and aids in the efficiency of ventilation.
5. Carbon dioxide content as high as 20 parts in 10,000 does not have a bad effect upon the ventilation.
6. Ventilation by recirculation is both efficient and economical. At the end of a year's run the teachers are almost unanimous in their praise of the system.
7. With a recirculating system such as this, it requires from 40% to 50% less steam to heat the building while the fan is in operation than would be required if the air was drawn from outdoors for the same length of time.
8. Air movement keeps the temperature uniform in various parts of the room and decreases the amount of steam required for heating. The tests show a minimum saving of about 8% due to this air movement, and this would be true whether the system is a recirculating one or otherwise.
9. The air washer absorbs a considerable amount of the carbon dioxide contained in the air passing through it.
10. The air washer is apparently quite efficient as a dust remover, but does not remove bacteria from the air when the washer water is recirculated. The tests show that it actually supplies bacteria to the air under such conditions.
11. In spite of the poor showing of the washer, the air entering the room carries no more bacteria than outside air when the relative velocities in which the plates were exposed are taken into account.

The question in the writer's mind is whether equal or superior results can be obtained at equal or less first cost, cost of operation, etc., in schoolrooms by means of (a) window ventilation and direct steam or water heat; (b) direct-indirect steam or water heat supplemented by a positive fan exhaust; or (c) by the split system; i. e., direct radiation for heating, and air tempered for ventilation only.

SUGGESTED VENTILATION STANDARDS WHEN USING FRESH AIR ONLY.

In order to have something tangible for discussion, the following tentative suggestions are advanced for standards of ventilation on the basis of admitting fresh air only into the apartment:

(a) The writer does not believe that satisfactory ventilation can be secured by means of window ventilation alone in a schoolroom or any similar room so densely occupied, even if supplied by ample exhaust ducts acted upon by powerful exhaust fans.

It is important to keep in mind that approximately 80% of the complaints relative to lack of ventilation are caused by excess temperature and humidity, rather than lack of fresh air. Further, it can be demonstrated that a well-designed window plus one or more good thermometers, in combination with common sense, will insure satisfactory ventilation in any apartment not occupied more densely than one person to 1,900 cu. ft. of space. The CO_2 can be maintained at approximately 9 parts in 10,000, humidity at approximately 25% during average winter weather (80% of the heating season), and the temperature at 65° to 70° F. without undue attention. (See the article entitled "Efficiency of Various Ventilating Systems," contained in Public Health Report, Vol. 37, No. 6, dated February 10, 1922, which contains data submitted by Professor Winslow of Yale and Sanitary Engineer Leonard Greenburg of the U. S. Public Health Service, which data are of great value to the ventilating engineer.)

Surgeon General Gorgas has stated that 50 sq. ft. of floor area per man in barracks with a ceiling height of 9 ft. should be the minimum, although many of the war-time cantonments had only 250 cu. ft. of space per man. This latter was found to be unsatisfactory, and 450 cu. ft. per man is now considered the minimum. It should be kept in mind that the men are in vigorous health and are not to be compared with the average citizen in resisting power.

PRESENT PRACTICE IN THE DESIGN OF EQUIPMENT FOR FEDERAL BUILDINGS.

The writer's practice in connection with the design of heating and ventilating apparatus for Federal buildings under control of the Treasury Department has been roughly as follows:

Window ventilation is used in all office rooms; no vent or exhaust flues are used in any of these rooms. Practically all office rooms in such buildings contain at least 1,500 cu. ft. per occupant, and the exposed windows and doors equal roughly one-fourth of the floor area of the rooms. A generous number of glass window ventilators and deflectors is provided on request for any and all apartments, and for summer use a liberal number of desk fans is provided for the various buildings.

In post-offices the workroom and the adjoining public lobby are frequently flushed out; the workrooms by the opening of doors to receive and dispatch the mails, and the lobbies by the opening of the entrance doors by the public. In the larger workrooms, and, in fact, in any room deeper than 30 ft. from the outside wall and without cross ventilation, the air is stagnant in the inner part, and some method of inducing a flow of air at that point is desirable.

If we could only impress upon the architects the necessity of providing properly-designed windows, and especially the necessity for cross ventilation, about 50% of all ventilating problems would be solved.

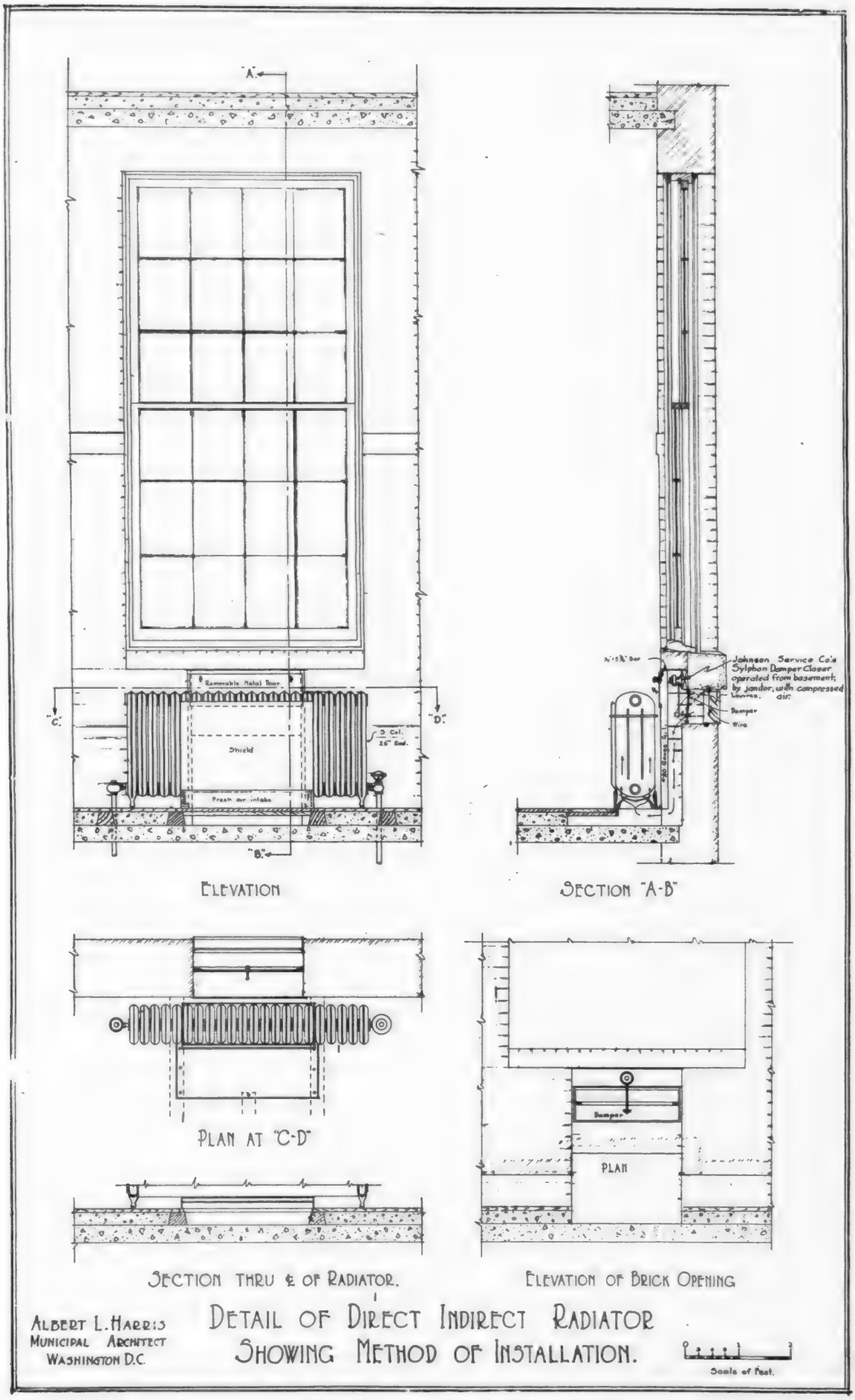
HIGH TELMPERATURE ON MEZZANINE FLOORS.

Of course all mezzanine floors or half stories in a high ceiling workroom, if not entirely isolated from the main room, are very uncomfortable. This is not due, however, to bad air, but to high temperature; and the remedy is either to seal them off from the main room or to force fresh air into these spaces and keep it stirred up with ordinary oscillating desk fans.

Court rooms must of necessity be equipped with some kind of ventilating apparatus. In the smaller ones unit systems, direct-indirect or gravity-indirect, are used as conditions demand, while in the larger buildings the court rooms are treated from the general ventilating system.

The split system of ventilation is used, i. e., air is admitted for ventilation only and no exhaust or vent flues are used except in the court room, post-office workroom, and toilet rooms. Direct radiation is installed to heat the rooms.

Automatic temperature control is used in the largest buildings when funds are available, and an air washer is installed unless



DETAILS OF INLETS TO DIRECT-INDIRECT RADIATORS AS WORKED OUT BY ALBERT HARRIS, MUNICIPAL ARCHITECT, WASHINGTON, D. C.

the atmospheric conditions permit its omission, which is seldom the case. So far, no special humidifying apparatus has been installed.

WHEN DIRECT-INDIRECT SYSTEMS CAN BE USED.

(b) In buildings containing not over sixteen schoolrooms, in clean cities like Washington, Denver, Seattle, etc., when no industrial odors exist near the school site, and when first cost is of paramount consideration, the writer believes that satisfactory ventilation may be secured by use of the direct-indirect system with the air passages properly designed and arranged to be readily cleaned, if supplemented by properly-designed windows which will admit air without drafts, and especially if supplemented by a positive exhaust system using an exhaust fan designed to remove 30 cu. ft. of air per minute per occupant.

The basis of this design should be a low-pressure two-pipe vapor or vacuum system with hand-operated graduated inlet valves located at top of radiator. The radiation to be designed to heat the room as usual from the lowest outside temperature plus sufficient additional surface to heat 10 cu. ft. of air per minute per occupant from the lowest outside temperature to 70° F. The windows are to be used at all times, when weather and temperature permit, to supplement the air entering through the radiators.

Albert Harris, Municipal Architect of Washington, D. C., has worked out details in connection with inlets to direct-indirect radiators which are worthy of note, and which permit fairly ready access for cleaning, etc. He has also worked out a very satisfactory window to supplement the direct-indirect system.

This system is not brought forth as ideal, but it has the virtues of simplicity, low first cost, and low operating expense; virtues which in a large measure offset its objectionable features. Dr. Vernon Hill's investigation and report of recent date entitled "Weak Spots in Direct-Indirect Heating" (published in THE HEATING AND VENTILATING MAGAZINE for January, 1922) is illuminating on this subject. The writer feels that if the apparatus be properly operated the following results may be obtained during 70% of the heating season:

Temperature: 65° to 72° F., controlled by teacher. (Consider this of prime importance.)

Relative Humidity: 35% to 45%.

Dust: Not perceptibly greater than exists in outside air if air passages and radiators are kept fairly clean. In this connection do not overlook the fact that in ventilating systems using a fan without air washer the duct systems are in a large majority of cases receptacles for dust and dirt.

Odor: Not perceptibly greater than exists in outside air if air passages and radiators (and the pupils) are kept fairly clean.

Air Movement and Distribution: Fairly satisfactory if inlet and outlet openings are properly designed.

Bacteria: Not perceptibly greater than in outside air, unless some abnormal condition exists in the school or schoolroom.

CO_2: 15 parts in 10,000, approximately, when air is being taken through the radiators only. Say 9 to 10 parts per 10,000 during 70% of the heating season.

Certainly it will be conceded that the air conditions above noted, to which the pupils are subjected for 20% of the heating season, are better than, or at least comparable to, conditions existing in the homes of the school children or the occupants of public buildings, and certainly not materially worse than the conditions maintained by Nature outdoors.

COMPARATIVE COST OF DIRECT-INDIRECT SYSTEM AND SPLIT SYSTEM.

Upon actually similar eight-room school buildings designed by Mr. Harris, the bids for a well-designed direct-indirect system with positive fan exhaust, exceptionally well-designed air inlets, etc., were $10,000 less than for an equally well-designed split system of heating and ventilation with gravity exhaust and without an air washer. The two systems have not as yet been placed in service, so that relative operating costs have not been determined; but they do not differ materially. The direct-indirect system is designed to introduce through the radiators 30 cu. ft. of air per minute per pupil when the outside temperature is 35° F. and above; for the 20% of the time when the outside temperature is below 35° the air admitted through the radiators will be curtailed. The split system is designed to deliver 30 cu. ft. per minute per pupil irrespective of the outside temperature.

SPLIT SYSTEM MOST SATISFACTORY FOR LARGE SCHOOL BUILDINGS.

(c) In school buildings containing more than sixteen rooms, in cities where much smoke and dust and many industrial and other odors exist, such as Pittsburgh, Cincinnati, Chicago, New York, etc., and when first cost is not paramount, the writer believes the split system to be the most satisfactory, using direct two-pipe low-pressure steam, automatically or mechanically controlled, the air to enter rooms at a temperature not exceeding 65° F., and to be properly washed and humidified. During recess all rooms to have windows opened and to be flushed out as much as possible, with the plenum fan shut down. The following standards, we believe, may be obtained with this apparatus, if properly designed and operated:

(a) 15 cu. ft. of fresh air per pupil per minute, which will give approximately 10 parts of CO_2 per 10,000.

(b) 40% to 50% humidity (to be varied through the day by the engineer.)

(c) Temperature in rooms, 64° to 68° F., to be varied by teacher.

(d) Air movement, vigorous; high velocity in ducts and flues through net area of registers.

(e) Dust content. (f). Odors. (g). Bacteria. These, it is believed, would be considered satisfactory by Dr. Vernon Hill, based on his system of rating, unless some abnormal condition exists in school or schoolroom.

METHOD SUGGESTED OF ADMITTING AIR INTO ROOMS AT HIGH VELOCITY.

The writer is very strongly of the opinion that the method of admitting the fresh air from the plenum fans into the rooms as now practised will prove to be unsatisfactory when we attempt, as we should, to admit the air at a high velocity and low temperature. From personal observation of two or three very successful ventilating systems installed under the writer's direction, he feels that we should discharge from the inside wall flue at the ceiling of the classroom into a system of sheet-metal ducts or similar devices with perforations on the sides. This cool air, if at proper temperature, will descend without objectionable draft and find its outlet through the usual vent flue. He further believes that the usual vent flue could be dispensed with in this system and the air discharged into the corridor, where it may be exhausted through one main vent shaft. The writer intends to put the foregoing into practice at the next opportunity.

IMPORTANCE OF SIMPLICITY IN OPERATION.

A point of great importance which is overlooked by engineers who merely design heating and ventilating apparatus and who have no experience with the constructon, and especially with the operation of the apparatus after completion, is that the operator has no interest whatever in giving attention to a lot of details and fine points that are necessary to achieve the results in the mind of the engineer; and thus much money is spent for apparatus which is wholly or partially neglected in actual operation. The gist of this observation is that practical results must be aimed at in the design and must be carried out in a simple manner.

POSSIBILITIES OF THE ART OF WELDING IN PIPE CONSTRUCTION

The Remarkable Adaptability of the Welding and Cutting Torch to Cut Time and Costs on this Class of Work

BY FREDERICK K. DAVIS.

RAPID advances in the welding of pipe and fittings in heating and ventilating work, during the war period and the years following, has, in many ways, revolutionized former practice. In the accompanying article a few of the typical methods are shown together with one method of autogenous or local fusion welding.

In pipe work it is almost universal practice to use the oxyacetylene process, due to greater ductility in welds, lower first cost of apparatus and portability of equipment. While a few pipe shops use the electric arc for this work, it can be safely stated that probably over 90% use the gas torch. The electric arc and the spot welder, however, are used in many operations of interest to the heating and ventilating industry and it is hoped to present some data later on this branch of the art.

PRACTICAL USES OF A WELDING OUTFIT.

The principal uses of a welding outfit in the piping contractor's shop or on the job are many and varied. Fittings

FIG. 1—MAKING AN EMERGENCY FITTING IN THE FIELD.

which heretofore required expensive patterns and much machining, to say nothing of the delay in obtaining them, are now made from what would otherwise be scrap material. Also, with the welding process, broken tools and machines may be repaired without the delays which ordinarily attend such work. In the field Van Stone joints can be made and repaired and where pipe sections are fabricated too short or too long, they may be lengthened or shortened, as the case may be. Another important field use of welding oufits is where branch connections are required, due to changes or afterthought. These may be welded in with the greatest ease.

THE REPAIR OF GEARS.

An instance is reported by a fitter where several teeth were stripped from the gear of a ratchet die stock. To have obtained a new gear would have necessitated a wait of at least three days. The repair was made by the use of the welding torch in an hour.

USES OF THE CUTTING TORCH.

It is assumed that a cutting torch is purchased with a welding torch, when buying an outfit, and it is a great economy to do so as continual uses are found for it which save time and labor. Pipe can be regularly cut to lengths quicker than the pipe machine can do it and, in the larger sizes of pipe, cutting on the floor or pile means that only the length required has to be handled. For this reason extra laborers are not needed to handle the long lengths of pipe where only a short piece is to be cut off.

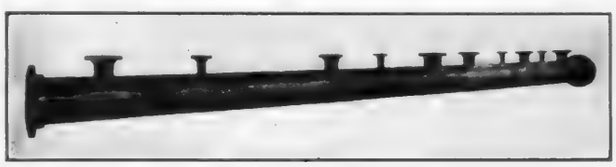


FIG. 2—18-IN. O. D. HEADER OF WELDED CONSTRUCTION.

When making a tee from scrap pipe, as shown in Fig. 1, the pipe is cut to shape with a cutting torch and then flanges are welded on, or, if screwed connections are required, the pipe is threaded before welding.

To produce the header shown in Fig. 2 in one piece by the older methods would have been practically an impossibility. Several joints would have been necessary and the weight would have been many times more.

MAKING VAN STONE JOINTS IN THE FIELD.

In Figs. 3 and 4 is shown a method of making Van Stone joints in the field or on larger sizes of pipes or tanks than the shop machine can handle. The ring is tack-welded to the pipe and the end of the pipe to be flanged is heated with the welding

FIG. 3—COMPLETE VAN STONE JOINT MADE WITHOUT USE OF MACHINERY.

torch and flanged over the ring. The illustrations also show the method of making smaller pipe size connections by welding in nipples. It is common practice with several of the large heating contractors, on long lines, to practically ignore any branch or connection under 3 in. in fabricating the line and to weld these in when the line is in place. The saving in flanges

FIG. 4—METHOD OF MAKING VAN STONE JOINTS WITH WELDING OUTFIT.

FIG. 5—WELDING 16-IN. PIPE IN THE FIELD.

FIG. 6—SIX LENGTHS OF 16-IN. O. D. PIPE, EACH WEIGHING FROM 1100 TO 1400 LBS., WELDED TOGETHER AND BEING LOWERED INTO TRENCH.

FIG. 7—WELDING 16-IN. PIPE IN POSITION IN DITCH.

FIG. 8—FIELD WELDING WITH PORTABLE OUTFIT.

FIG. 9—PIPE LINE WELDING, SHOWING METHOD OF LINING UP SECTIONS.

and fittings makes a respectable showing and the connections are exactly where they are wanted.

STRENGTH OF PIPE WELDS.

An idea of the strength of pipe welds may be seen from the illustration reproduced in Fig. 6. The pipe being lowered into the ditch, it will be noticed, extends some distance beyond the support. After the lengths of pipe are lowered the welding together of adjoining sections in place in the ditch is accomplished in the manner illustrated in Fig. 7. However, where the

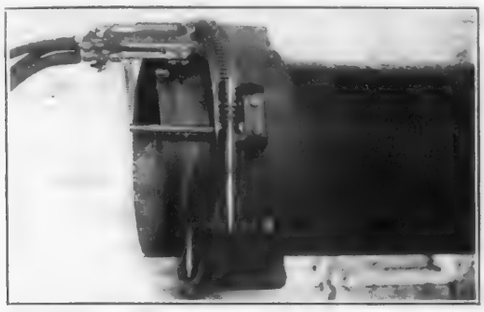


FIG. 10—MACHINE FOR CUTTING ENDS OF PIPE.

run is straight and not curved, as in Fig. 5, the usual practice is to weld the line in approximately 1000-ft. lengths and roll it into the ditch. A fall of 6 or 8 ft. does not seem to affect the weld, nor does the pulling of the entire 1000-ft. length endwise to align it with the adjoining section weaken the joints. The writer has seen several lengths of 14-in. pipe, each approximating 1200 ft. in length, rolled and dropped 7 ft. in a ditch, pulled 1 ft. endwise to position and then tested to 750 lbs. per square inch without showing a leak.

METHODS OF ALIGNING PIPE LINE PRIOR TO WELDING.

A very clear idea of the way pipe welding is done in the field may be gained by referring to Fig. 9. The clamp on the pipe line shows the method used for lining up two sections for preliminary tacking together. It is customary, however, on large diameter pipe, to use two lengths of angle-iron about 5 ft. long. This length may be reduced to from 2 to 3 ft. on the smaller sizes. Four pairs of bolts and four bars of flat iron, long enough to straddle the pipe and drilled at each end for bolts, are what is commonly used. The angles are bolted up tight, drawing the pipe into alignment and welds are made on opposite sides about twice as long as the thickness of the pipe. The bolts are then slackened and the angles moved a quarter of a turn and two other welds made between the first two. The clamps are then loosened and slid to the end of the pipe for the next section. No other rigging is required for this work.

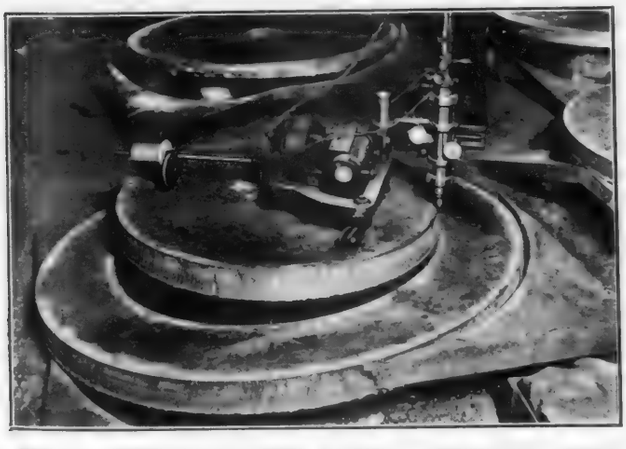


FIG. 11—CUTTING FLANGES WITH RADIOGRAPH FROM SCRAP METAL.

CUTTING OF FLANGES.

How easily flanges and rings may be cut from plate is illustrated in Fig. 10 which shows a radiograph in operation. While steel flanges are standard and can be purchased in the rough blank from the steel mill, many shops having scrap stock are cutting their own flanges by the method illustrated. One eastern shipyard is cutting all the flanges for its pipe shop from boiler scrap. Flanges from 3-in. diameter and up may be cut in this manner at a remarkable saving in cost over that of the purchased article.

Still another refinement in the use of cutting machines is the method which has been developed for cutting off the ends of pipe square and true (Fig. 11). Either a straight, square edge may be had or a bevel for welding, as desired by the operator.

COST OF WELDING OUTFITS.

The portable welding outfit shown in Fig. 8 is similar to those used by public service corporations. All equipment and gases

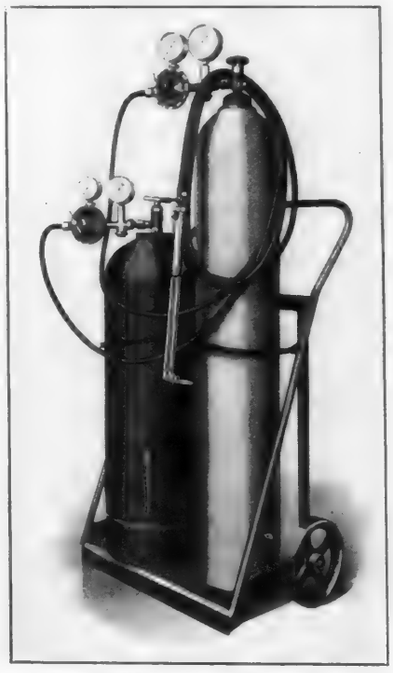


FIG. 12—PORTABLE WELDING OUTFIT.

are contained in the shed on wheels and it is arranged to be locked and left on the job from day to day. The portable outfit shown in Fig. 12 is designed for use in shop work, but the same outfit can be adapted to field work by obtaining a truck with wheels of larger diameter and broader face. The cost of such an outfit, consisting of welding torch, cutting torch, a set of welding and cutting regulators, hose and truck, will be approximately $350.00. With proper care the depreciation and renewal charge for tips, etc., should not exceed 20% annually where the outfit is in daily use.

TYPES DEVELOPED TO CUT CAST-IRON.

Recent developments in welding apparatus make it feasible and practicable to cut cast-iron and many instances are noted where old heaters or other equipment too heavy or bulky to handle have been cut up handling size at a fraction of the cost by any other method. The usual method of drilling and splitting large fittings to remove them is obviated by simply cutting them off with the torch.

In repair work on heating systems much time, labor and expense can be saved by cutting off the line at the old fitting, making a new fitting with the welding torch and welding it into the line.

EXPERIENCED WELDERS NOW AVAILABLE.

Prior to the World War experienced welders were hard to obtain, but so many men were trained by the Government and by contractors working on large piping installations that this problem does not exist at present. In fact, good welders are as easily obtainable as good fitters.

IMPORTANCE OF USING GOOD WELDING WIRE.

In connection with the welding of pipe or fittings a word of caution may not be out of place. Don't make the mistake of thinking that any wire is good enough for this work. The best results are obtained by using nickel-steel wire. If this is not at hand wire carrying less than 0.001 carbon, or what is known as 10-point carbon or under, should be used and it must be free from sulphur. With suitable wire and a reasonably good welder, pipe joints and fittings can be and are being made several times stronger than commercial screwed or flanged joints. Moreover, they are tight and stay tight.

RECENT TESTS ON AUTOMATIC VENTILATORS

Results Obtained Which Indicate the Comparative Capacities of Various Types of Ventilators for Removing Air from Enclosures

BY A. J. MACK,
Assistant Professor of Mechanical Engineering, and
C. J. BRADLEY,
Instructor in Mechanical Engineering, at the Kansas State Agricultural College.

THE first of these articles on tests of automatic ventilators appeared in THE HEATING AND VENTILATING MAGAZINE for October, 1920. The article attracted a great deal of interest and, in a number of cases, resulted in requests by manufacturers to have their product included in the tests. This resulted in a decision to continue the tests and include as many commercial ventilators as possible. Accordingly, twenty-two representative ventilators were secured through the courtesy of the various manufacturers of ventilators. The tests were again made in the Engineering Experiment Station of the Kansas State Agricultural College.

DESCRIPTION OF TESTS.

In establishing a method of test, it was conceded that there were many factors which would influence the practical performance and selection of a ventilator so that certain limitations were essential. It was finally decided that the performance of the wind was the most essential problem to be investigated. It was especially desirable to secure data upon the advantage of the various types of ventilators and to ascertain, if possible, what principles of design should be incorporated to secure the most efficient ventilation. These experiments, consequently, were limited to these phases of the subject.

The equipment used in the investigation was constructed to approximate actual wind conditions as nearly as possible.

In the tests previously described, a tunnel 15 ft. long and 26 in. square was used, but in the tests described in this article a tunnel 32 in. square and 16 ft. long was used. In one end of the tunnel a variable speed fan was placed and about 3½ ft. from the other end of the tunnel a vertical pipe was inserted which protruded about 2 in. above the floor of the tunnel for receiving the ventilators.

The entire apparatus was placed in a room large enough to eliminate all perceptible drafts caused by the fan. The temperature of the air in the tunnel was equal to that of the room and the effects of natural ventilation were thus removed. Suitable screens were also employed to straighten the air currents.

In performing tests a ventilator was placed over the pipe in the tunnel. The speed of the fan was next regulated to produce the desired wind velocity. Readings of the wind velocities in the tunnel and of the air through the ventilator pipe were taken with an anemometer. Data were also taken on the velocity of the air induced in the ventilator pipe when no ventilator was inserted in the tunnel.

CLASSIFICATION OF AUTOMATIC VENTILATORS.

As to construction, automatic ventilators may quite readily be subdivided into four types, dependent upon the means utilized in producing additional draft: the plain stationary, the siphoning stationary, the plain rotary and the siphoning rotary.

The plain stationary type of automatic ventilator makes no special provision for utilizing the wind velocity in producing additional draft. Plain stationary ventilators are illustrated by (a) and (b), Fig. 1. They consist of simply a cap over the opening in the enclosure which prevents direct entrance of rain or snow and are made storm-proof by a hood or circular band.

The stationary siphoning ventilator is illustrated by (c), Fig. 1 and the principle of operation is based upon the breaking up of the wind currents and directing them in such a manner as to create a decreased pressure in the upper portion of the ventilator. Ventilation is secured by ejector action.

The plain rotary ventilator, note (e), Fig. 1, is of the ordinary rotary type and no special attempt is made to increase the velocity of the air through the ventilator. The illustration is self explanatory.

The so-called siphoning rotary ventilator is illustrated by (f) and (g), Fig. 1. In this type an attempt is made to change the pressure head of the prevailing wind to a velocity head, thereby making use of the ejector action to increase the velocity through the ventilator. In some cases the ejector is placed within the ventilator pipe, as at (e), while in other cases, as in (f), the ejector arrangement surrounds the ventilator pipe. An example of an air turbine is illustrated by (d), Fig. 1.

TABLE 1—RESULTS OF TESTS ON SEVEN PLAIN STATIONARY VENTILATORS.

Induced Velocities in Ventilator Pipe in Feet per Minute.

Velocity of wind in miles per hour.	No Ventilator	Ventilator Number						
		1	2	3	4	5	6	7
4	145	185	266	148	185	142	133	160
8	241	287	355	257	287	238	242	267
12	337	390	446	366	390	334	350	375

TABLE 2—RESULTS OF TESTS ON SIX STATIONARY SIPHONING VENTILATORS.

Induced Velocity in Ventilator Pipe in Feet per Minute.

Velocity of wind in miles per hour.	No. Ventilator	Ventilator Number. 1	2	3	4	5	6
4	145	162	157	226	189	205	206
8	241	304	292	404	315	332	369
12	337	446	426	583	440	458	532

TABLE 3—RESULTS OF TESTS ON FOUR PLAIN ROTARY VENTILATORS.

Induced Velocity in Ventilator Pipe in Feet per Minute.

Velocity of wind in miles per hour.	No. Ventilator	Ventilator Number. 1	2	3	4
4	145	208	192	191	202
8	241	346	348	354	341
12	337	484	505	518	480

TABLE 4—RESULTS OF TESTS ON FIVE ROTARY SIPHONING VENTILATORS.

Induced Velocity in Ventilator Pipe in Feet per Minute.

Velocity of wind in miles per hour.	No. Ventilator	Ventilator Number. 1	2	3	4	5
4	145	257	192	222	217	204
8	241	479	370	387	410	393
12	337	702	548	553	606	582

One turbine type ventilator was grouped with the rotary siphon ventilators.

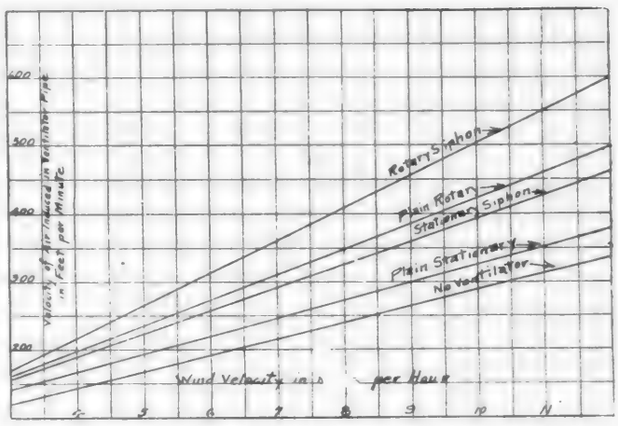


FIG. 2—RESULTS OF TESTS BASED UPON AVERAGE VENTILATORS IN EACH GROUP.

TABLE 5—RESULTS OF TESTS BASED UPON AVERAGE VENTILATORS IN EACH GROUP.

Induced Velocities in Ventilator Pipe in Feet per Minute.

Velocity of wind in miles per hour.	No. Vent.	Plain Stationary	Siphoning Stationary	Plain Rotary	Rotary Siphoning
4	145	168	191	198	218
8	241	273	326	348	408
12	337	379	461	497	598

Table 5 is also illustrated graphically by Chart No. I, which will give a clearer conception, possibly, of the relative capacities of the type.

CONCLUSIONS.

Before attempting to draw any conclusions from these results, it may be well to mention one or two important facts:

1. The test apparatus while designed to reproduce actual wind conditions, approaches this only approximately. In the actual installations, the wind has its progress arrested by the building.

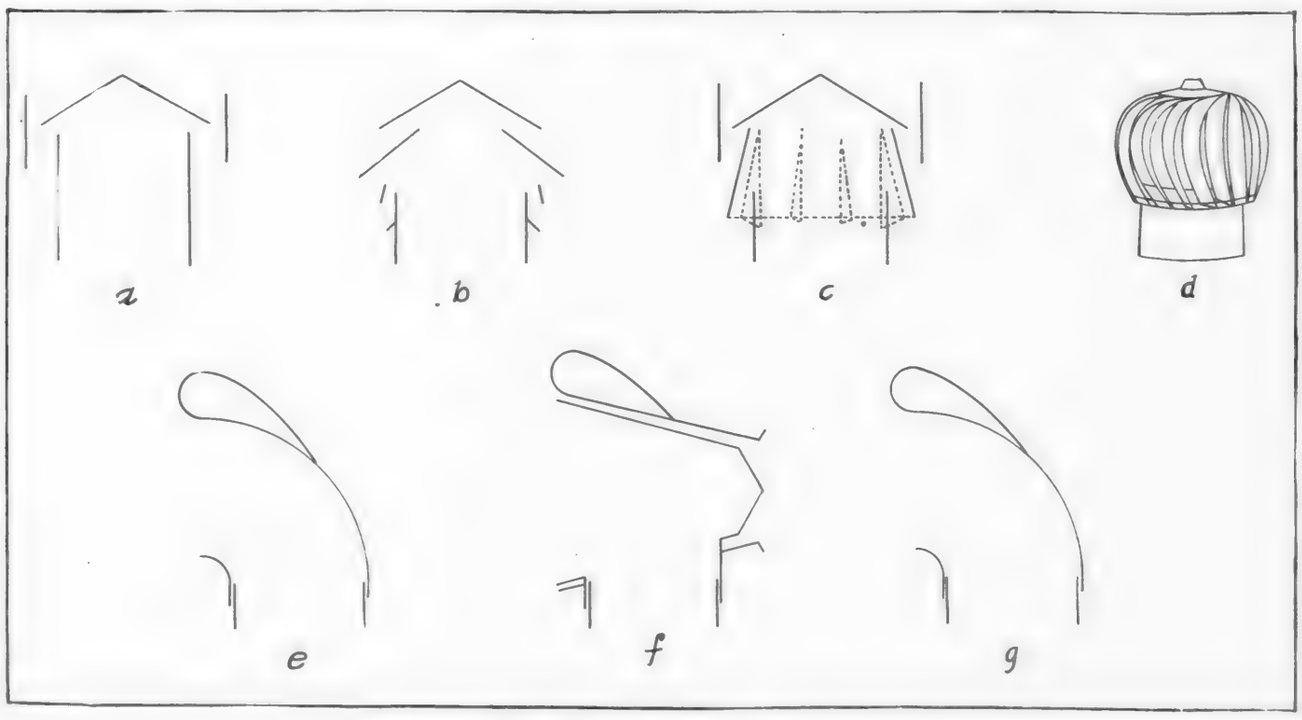


FIG. 1—VARIOUS TYPES OF VENTILATORS TESTED.

A portion of this air enters the building through any existing crevices. This theoretically increases the pressure within the enclosure and materially increases the velocity of the air passing through the ventilator. Thus, it would seem that the results secured in this investigation are only approximations and would be applicable only to exceedingly tight or well-built buildings.

To compare the results with actual installations, a 10-in. ventilator pipe was inserted in a small outbuilding accessible to the wind from any direction. No heat was supplied to the building during the tests and readings of the wind velocity and the induced velocity through the ventilator pipe were read when various types of ventilators were used. The variable velocity of the wind made the readings rather erratic, but when the tests extended over several days, the average results checked fairly closely with those secured in the laboratory. It was thus concluded that the test results were fairly representative. They are at least conservative values of what should be expected in actual installations.

2. The results were obtained on rather small ventilators. Commercial ventilators, as a rule, are much larger than those used in the investigations. This may also alter the aspects of the problem, although probably not to a great extent.

One of the important conclusions that may be drawn from this investigation is that a wide range of effectiveness is found in the ventilators of each type. Some ventilators in each type gave exceedingly high ventilating effect, while others were comparatively poor. The range was most pronounced in the non-siphoning stationary type. At least one of the plain stationary type did not give as good results as no ventilator. Much of this could have been overcome through improvement in the dimensions used in the design. Measurements on the various types indicate plainly that those having very ample and unobstructed openings gave by far the best results. The position and width of the storm band also appeared to affect the results. The wider band judiciously placed results in greater efficiency.

As judged from the results of different types of ventilators tested, it would appear that a slight gain is made by using the wind to better advantage. In order of their effectiveness come the rotary siphon, the plain rotary, the stationary siphoning and the plain stationary. The gain in effectiveness appears to be more pronounced between the rotary siphoning and the plain rotary and again between the stationary siphoning and the plain stationary. The gain in effectiveness is not so pronounced between the plain stationary types and the open hole.

One fact seems to be overlooked in some of the siphoning ventilators especially. Any air entering the ventilator for siphoning purposes must be exhausted. The free area should, consequently be designed to care for this additional air.

These conclusions are based upon results obtained on actual types of commercial ventilators. It is proposed to continue the work and include some experimental work with the investigations to determine laws and formulas to govern the design and construction of still more efficient ventilators.

EFFECT OF CONSTRUCTION ON HEAT LOSSES FROM BUILDINGS

What It Means to Have Walls and Windows Well Built, and to Have Air Spacing Between Walls

BY S. HOMER WOODBRIDGE

I

UNDER fixed conditions of wall material, thickness, construction and exposure, and of inside and outside weather conditions, the rate of heat loss is proportional to the extent of exposed wall surface. Cubic contents in no way affect that rate, except as related to the surface of exterior confining walls. Maximum thermal economy makes necessary an enclosing of maximum space within a minimum of enclosing wall. In the spherical form the maximum of content is encompassed by the minimum of enveloping surface. That form is wholly impracticable in building construction. In the case of a cube having equal volume with a sphere, the ratio of enclosing surface to contents is 24% greater for the cube than for the sphere. The cubical form is practicable for building construction, though impossible of universal adoption.

MINIMUM WIND RESISTANCE IN OCTAGONAL AND ROUND BUILDINGS.

In this connection it may be interesting to note the fact that the ratios of the contents of spheres and cubes to their surfaces vary as their diameters, and that in this fact is found the explanation of the floating in air of minute particles, such as fine dust, smoke, fog, cloud, and of the greater parachute effect as particles become smaller. If for diameter one the ratio of content to enveloping surface is one, then for diameter 0.01 the ratio of contents to surface becomes 0.01. The more nearly particles approach molecular size, the more they are subjected to the diffusive effects of molecular impact which tend to hold them in suspension.

Octagonal structures, such in form as Washington's famous grist mill on his Mt. Vernon estate, are to be found here and there, mostly in evidence of experience in gales at sea, the octagonal form combining strength of structure with a wall shape offering minimum resistance to the impact of wind. Occasionally buildings enclosed in walls of circular form are constructed, the most modern and colossal of which is that of the projected New York City Court House. The round house has the thermal advantage in maximum degree of the more common octagonal form of buildings. The area of wall for a square building of any given cubic contents is to that of a round building of the same cubic contents, and equal height, as 113 to 100. Thermal economy in circular forms of buildings is in excess of that gained by reduced area of wall because of the decreased pressure of wind in case of the circular building, and the corresponding reduction of inward air leakage under wind action. The further the departure from minimum exterior walls for any given cubic contents, the greater the thermal loss per unit of cubical content.

The relation of form to thermal economy is furthermore important in the matter of exposure to wind effects and resulting air pressure against walls. Forms which furnish wind pockets, such as courts, or recesses, open to windward, providing open arms which, as it were, receive and embrace the wind, are costly. Wind blowing into such pockets, though coming to rest within them, may, and generally does, produce upon all the walls of such open courts a per-square-foot static pressure equal to the square root of the per-second velocity of wind divided by 29, or $p = \sqrt{\frac{V}{29}}$. A 30-mile wind blowing into the mouth of such a pocket would produce a pressure on all enclosing walls averaging 2.31 lbs. per square foot. Wherever such pressure exists it correspondingly increases the in-

ward leakage of air, both molecular and mass. If such pockets, or courts, are exposed to quarters from which the prevailing winds blow in the coldest weather, the warming of those portions of building so exposed is made the more difficult and costly. If, therefore, wings, and open courts, and outreaching arms must characterize a building, thermal economy for such shapes requires that such exposures shall be to windward in times of milder weather rather than of severe cold; that they should open southward and eastward rather than northward and westward in northern latitudes.

MATERIAL AND MANNER OF WALL CONSTRUCTION.

The thermal function of a protecting wall is two-fold; first, to maintain internal warmth against heat loss by transmission; and, second, to prevent the entrance of outside cold air by filtration and inflation. A fur wrapping serves both purposes when the wearer is exposed to a cold wind, the fur acting as a thermal insulator, and the skin, or leather, as an air stop. The maximum thermal conserving effect from such a wrap is had when the skin is outermost and the fur innermost. If the fur is outward, the effect of wind and of molecular activity is to so fill the fur interstices with chilled air as to largely reduce insulating value; whereas with the fur inward, the warmed air is not so dislodged as to materially reduce the insulating efficiency of the fur, and the leather as equally as before protects against the inbeating of outside cold air.

Likewise, the maximum thermal effect of the walls of buildings is when their construction embodies the principle illustrated in the fur coat: viz. an impervious skin on the outside, within which insulating material of the best available quality and form is placed. In case of frame and wooden constructions, closely laid clapboards with joints and material well sealed with filling paint serve the purpose of an impervious skin so long as the construction remains tight. If made so at the outset, it is likely in time to become warped and open through drying and shrinkage. A shingled wall is more liable to openness than a wall of clap-boards. Paint cannot so perfectly seal a shingled wall. Paint furthermore oxidizes, and pulverizes after a relatively short exposure, and to that extent ceases to function as a seal. Because of these defects, it is generally important that some such material as well-filled tar paper be placed between the sheathing and the clapboarding as a protection against air leakage. The lighter woods are among the best of insulators, 1-in. thickness of soft pine board being equivalent in insulating effect to from 6 in. to 7 in. of porous brick. Such boarding next to and within clapboards and the impervious shell of paper affords good insulation when combined with a secondary wall of lathe and "back-plaster."

In brick construction, the outside course should be close grained and hard pressed, or even enamelled, brick laid with close joints in cement mortar as an outer shell, the inner wall being of light or porous brick laid in lime mortar. The porosity of brick walls, which is much larger than is commonly supposed, may be for the most part overcome by filling with thin cement wash applied in two or three coats, or, where the treatment is permissible, by a wash of alum and soap mixture.

AN INSTRUCTIVE EXAMPLE OF MISCONSTRUCTION.

The large practical importance of a proper placing of the impervious and the insulating materials of walls may be illustrated by a single citation from personal experience. A 240-ton ice loft was provided with walls consisting of 12-in. of brick, 1 in. air space, 8 in. of brick, studding and 2 in. air space, ½ in. pine sheathing, studding and 2 in. air space, ½ in. pine sheathing, 2 in. hair felting, pine sheathing, two layers of heavy tarred paper laid with broken joints and tacked to place, smeared on both sides of each layer with hot coal tar, and the whole surface given a final triple coat of melted tar.

The insulating ceiling was made up of 3-ft. depth of mill-shavings laid on plank flooring, the flooring supported on beam construction. Beneath the beams was closely-laid pine sheathing. The sheathing was covered with a double layer of heavy tarred paper laid with broken joints and all surfaces liberally smeared with tar.

The results were disappointing as to insulation. When, following the diagnosis of the case and advice as to remedy, the inner walls were opened for examination, the wool felt was found to be wringing wet, and the adjacent woodwork saturated, because of moisture which, as vapor, had by molecular travel passed through the entire composite wall construction, to condense at the dew-point temperature produced by the stored ice. The paper of the ceiling, which hung in shallow festoons, when slitted with a knife, let through streams of water wherever pierced. That water was the condensation of vapor, which by molecular travel had passed through shavings and planking and air space and sheathing, until it reached the impervious paper, or the dew-point above it, where condensation took place. The results described seriously reduced the insulating value of the entire wall and ceiling construction, all of which might have been obviated by placing the impervious coating, or shell, upon the outside rather than upon the inside. Such a coating, or shell, so placed would very largely have prevented the entrance of vapor molecules, and such vapor as might pass through such intercepting coat would have travelled through the insulating construction to and into the ice chamber, leaving that construction in a practically dry condition. The placing of the impervious skin upon the inside resulted wastefully as to ice, and to the insulating structure itself through wetting and rotting.

THERMAL EFFECT OF THE NATURE OF THE EXTERNAL SURFACE OF INSULATING WALLS.

Roughness increases the area of surfaces, and for that reason affects the radiation rate, that rate varying for any given material as the extent of exposed surface varies. In general, therefore, roughness of wall surface tends to increase, and smoothness to decrease, radiation factors. A rough stucco, or pebbled, wall surface, is a greater heat loser by radiation than the same wall material and surface trowelled to a smooth finish.

The rate of convection is less affected by surface character. Roughness involves recesses, and recesses retard circulation by pocketing air.

A laboratory test made, and three times repeated, under the supervision of the writer, furnished results confirming in a remarkable manner the correctness of reasoning as to the thermal significance of the physical nature of surface exposure. A cylindrical vessel made of clean and bright galvanized-iron, size 8 in. in diameter, and 18 in. deep, was filled with water at 200° and allowed to cool through walls only, bottom and top being well insulated in the same manner for all test. The tests were made within a room the walls and air of which were kept at very nearly constant temperature. The contained water was continuously agitated by an electrically-driven disc fan-circulator run at uniform speed during all tests.

If the rate of cooling through the bare metal was 100, when the vessel was closely wrapped with one thickness of medium-weight gray blotting paper, the rate of cooling rose—according to memory—to 128; with two wraps similarly applied to 117; with three wraps to 103; and with a fourth wrapping dropped to 92.

That seeming thermal paradox—of increasing the cooling rate by wrapping it with layers of the best known non-conducting material—is readily explainable by an intelligent application of radiation tables as applied to the case. Partly because of the largely extended surface due to minute roughness, the radiating power of gray blotting paper is approximately nine times that of bright and smooth zinc. The little gain afforded by a thin blanket covering of fluffy paper is therefore far more than compensated by the nine-fold radiating, or cooling, power of the blanketing material. Not until the thickness of the insulating material becomes such that reduced conducting power

more than offsets increased radiating power does the cooling rate of the blanketed surface fall to that of the naked surface.

AIR SPACING WITHIN WALLS.

When the continuity of walls is broken by air spacing, the travel of heat by induction is interrupted, and that by convection and radiation is substituted. The rate of thermal transfer by radiation is not materially affected in such case by the width of spacing between two opposing faces of a wall. Transfer of heat by convection is considerably affected by the width of such spacing, and also by the vertical height offered within the spacing for air travel. The closer the two surfaces enclosing the spacing, the greater the frictional resistance to air travel, the more retarded and slow the rate of travel, and the more reduced the rate of heat transfer by that process. The shorter the distance of vertical travel, the less the velocity of such travel, and, correspondingly, the less the rate of transfer. Thus, in the case of the double glazing of windows, the insulating effectiveness of ⅛ in.-spacing between panes is markedly greater than that of a ½ in.-spacing. Avoiding actual contact, the closer the proximity of surfaces, the higher the insulating value of an air space, and the shorter the vertical distance travelled, the greater the thermal gain.

The value of air spacing is quite commonly overestimated. In the case of any material, its value may be expressed in terms of a computed thickness of that material. In the case of close-grained oak that thickness is 2½ in.; in the case of soft pine, 1¾ in.; for hard brick 4½ in.; and for soft brick, 3 in. For stone having high conductivity 25 in. and for stone of low conductivity 11 in.;—that is, the higher the specific conductivity of wall material, the greater the insulating value of an air space becomes, and the thicker the wall, the less is that value.

APPLICATIONS OF AIR SPACING.

In frame buildings the practice of "back plastering," and in brick construction the use of tile blocks, afford common examples of effective insulation by air spacing. In the case of terra-cotta blocks, the insulation becomes of greater value when the open ways within the blocks are in horizontal, rather than in vertical, position; and with double plastering the insulation value of spacing is increased when the vertical spaces are broken by frequent stops.

The insulating value of porous and of fibrous material is due to the effective manner in which the substance is broken up into multitudinous air cells, alternating with solid material separating those cells, each cell interrupting conduction and substituting radiation and convection. Hence the insulating effectiveness of material, of high conductivity in the solid form, when that same material is converted into a loose and fibrous form, such as mineral wool, diatomaceous earth, powdered material of any description.

Cabot's quilting, which consists of a matting of the relatively coarse fibers of eel grass, when placed as a continuous covering over the sheathing and under the clapboards of a building, affords thermal protection to a marked degree, and in two ways: first, the double layer of impervious paper serves as an air stop; and, second, the fibrous material is of such effective insulating value that, when properly applied to building construction, the rate of heat loss has been found by repeated experience to be reduced from 100% to quantities varying from 65% to 75%. The quilting is low in cost, is non-inflammable, practically indestructible, and is vermin proof. The material, in one form or another, has been used for centuries, in the tropical regions for the exclusion of heat from, and in higher latitudes for the retention of heat within, places of abode.

Let the heat loss from a residential building without such quilting insulation be 69,745 B. T. U. per hour at a time of average winter weather conditions, that being the total loss due to transmission, leakage and compass exposure. Let the saving by use of quilting applied to the same building be 28%, or 19,529 B. T. U. per hour. Let the surface protected by quilting be 6,000 sq. ft. inclusive of the unwarmed attic floor. The average saving for each square foot of protected surface is then 3.25 B. T. U. for each hour of 240 days, or 18,730 B. T. U. per square foot per year. That heat quantity is practically equivalent to the available quantity obtainable from 2½ lbs. of coal as commonly burned in domestic heaters. The total of yearly savings then, approximates 15,000 lbs. of coal, which, at $10.00 per ton, would cost $75.00

If the cost of the quilting in place is $20.00 per 1000 sq. ft. covered, or $120.00 for the building in question, the yearly interest cost at 6% may be put at 1/10 of the saving in fuel.

The type of insulation here referred to is not to be regarded as superior in all respects to other forms of material obtainable in the market.

An impermeable, and, at the same time, good insulating material such as the better makes of fibre board, may be used upon the inner side of outside walls, and, like Sackett's Board, serves as a good substitute for laths, or expanded metal, for overlaying with mortar. When dry, such board is an excellent non-conductor. As an air stop it is ideal when applied in large sheets with joints plaster-covered or otherwise effectively sealed. A ¼ in. thickness of the best fibre board has an insulating value equal to approximately 4 in. of the average quality of brick. Such material may be applied to the outer side of exposed walls when not subjected to wetting or dampness; but, for reasons to be considered later, there is one important advantage in using it as an inside, rather than an outside, material for outer walls.

Next month, Professor Woodbridge will discuss the effects of double-glazing and double-sashing, supplemented with notes on outward air leakage from buildings.

Effect of Regulation in Electric Heating of Railroad Cars.

Supplementing the discussion in previous issues as to the cost of heating cars by electricity, the accompanying figures are offered as a further contribution to the subject:

Power per mile for heating (unregulated)	0.84 K. W. H.
Power per mile for heating (regulated)	0.59 K. W. H.
Saving per mile	0.25 K. W. H.
Approx. mileage per car per heating season (Oct. 1911 to Mar. 1912)	13000
Cost per K. W. H.	$ 0.02
Saving per regulated car, 13000 x 0.25 x 0.02 per season	$65.00
Saving on 55 regulated cars per season	$3375.00

Notes of Investigations of U. S. Bureau of Mines.

Tests have been made at the Pittsburgh Experiment Station of the Bureau of Mines on the Speller process for removing dissolved oxygen in water heating systems. This process endeavors, by removing dissolved oxygen from the water, to retard corrosion of the hot-water pipes. An installation has been in use at the Pittsburgh station for about a year. The first test showed that the water heater did not heat the water to a high enough temperature when the most water is being used in the building, so the heater was covered with asbestos and a second test made. The oxygen deactivator proved efficient in removing dissolved oxygen provided the water entering the deactivator was kept at about 170° F. The investigation is being continued.

The objects of a new investigation being undertaken by the Bureau of Mines at the Pittsburgh experiment station on the determination of composition of gases arising from a thin fuel bed are: by blowing air at known rates through a fuel bed of known thickness, formed from anthracite, coke or bituminous coal, to find out the quantity and composition of the gases above the fuel bed; and so show how much air must be admitted to burn their combustible constituents.

ELECTRIC HEATING OF RESIDENCES IN TACOMA

Details of the Largest-Scale Application in America of Electric Energy to House Heating

It will come as a surprise to many to know that in Tacoma, Wash., no less than 925 customers of the Tacoma lighting plant are using electric current to heat their buildings. Of this total 795 of the installations are in residences, 54 in apartments and 76 in business or other buildings. These facts form the basis of a paper on electric heating of residences by Edgar Allen Leow, associate professor of electrical engineering in the University of Washington and recently published by the university's Engineering Experiment Station.

REASONS FOR LOW HEATING RATE.

It should be stated at the outset that for customers having an electric house-heating equipment, a minimum charge of $9.00 per kilowatt of maximum demand per year is made in Tacoma and a regular energy charge of ½ cent per kilowatt hour. The customer is required to have a separate meter on his heating load to take advantage of this rate, and is permitted to use this service only on air and water heating equipment.

Instead of being its principal load, Tacoma's heating business is in the nature of an excess or surplus power load. The fact is that in 1914 the city of Tacoma, finding itself with a hydroelectric plant on its hands having a capacity considerably in excess of that demanded by the existing or immediately prospective power and lighting requirements of the city, was confronted with the alternative of either letting the excess energy go over the dam unused, or stimulating additional demand for it outside of the ordinary channels. The domestic heating load offered possibilities of large additional loads if rates could be established which would make it economically possible. Such a rate would have to be low enough to encourage the use of considerable electric heating and still high enough to maintain coal and wood in a strongly competitive position from the standpoint of cost, so as to prevent the general adoption of the electric method. Up to the present time the ½-cent rate seems to have accomplished this result. Professor Leow raises the question, however, as to whether, with present prices of coal, the heating rate could not well be somewhat higher.

One other factor, it is pointed out, which has an important bearing on rates for domestic power, is the fact that the domestic power load and the industrial power loads are largely supplementary, that is, they require generating machinery capacity at different hours during the 24-hour period. This is illustrated in Fig. 1, which shows the total power curve and its component curves for January 10, 1921, a day on which the heating load was near its maximum value for the season. An examination of the curves clearly shows that the domestic load supplements the industrial load, thus making it possible to use the machine capacity to good advantage, as well as to dispose of an increased number of kilowatt hours. The curves show that even though the station may be fully loaded during the evening peak, the taking on of additional industrial load would affect this peak only very slightly.

THE BEGINNING OF ELECTRIC HEATING IN TACOMA.

The ½-cent rate covering the use of energy for house heating has been in effect since 1914. A small number of subscribers took advantage of this rate from the time of its first introduction. For the most part the electric heat was used as an auxiliary to heating plants of one kind or another, which were already installed in the residences. At the prices of coal and wood which then prevailed, electric heating, even at this low rate, was considerably more expensive than coal or wood, if used to supply full heating requirements. However, as an auxiliary to the ordinary furnace heating systems for use during short periods of time during chilly weather when a furnace fire is hardly necessary, the electric heater was found to be very satisfactory, as well as quite economical. It is thus apparent that even where rates are far less favorable than in Tacoma at the present time, electric energy for auxiliary heating may at times be used quite economically, although in a very limited way.

At the close of 1918 only 378 customers had taken advantage of the ½-cent heating rate. However, during the last year of the war and the years following, the prices of coal and wood increased rapidly and soon established a condition of approximate parity between the cost of heating electrically and heating in the ordinary way, which served to further stimulate the use of the electric method.

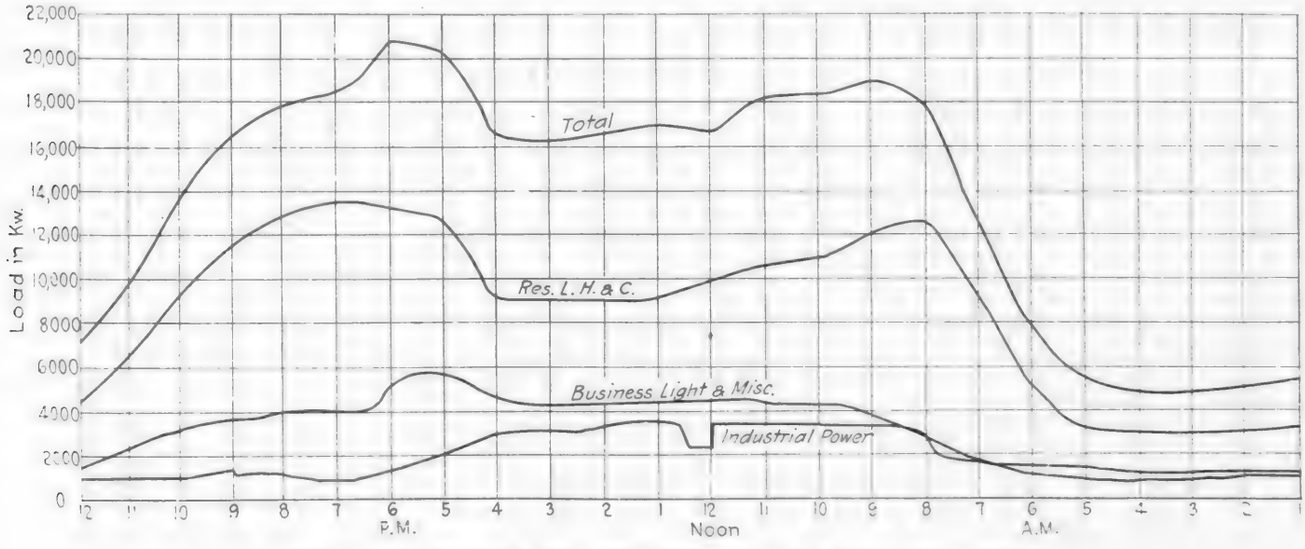


FIG. 1—ANALYSIS OF ONE DAY'S ELECTRIC LOAD IN TACOMA, WASH.
(Monday, January 10, 1921.)

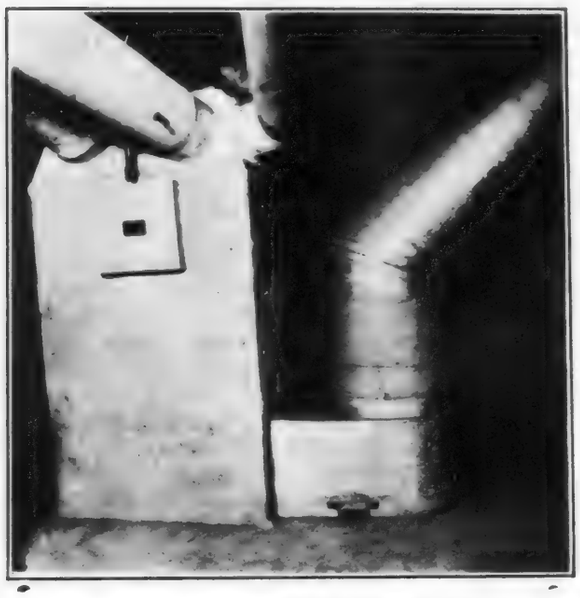


FIG. 2.—THE DIXON WARM-AIR ELECTRIC FURNACE.

FIG. 3.—WARM-AIR ELECTRIC FURNACE AND WARM-AIR COAL-BURNING FURNACE CONNECTED INTERCHANGEABLY.

ELECTRIC HEATING IN 1919.

Up to December 31, 1919, 547 customers had begun to use electric heat and were supplying either part or all of their heating requirements in this way. Of these 139, or about 25% of the total used this service throughout the entire 12-month period. Again of these 36 had a connected load of less than 4 kilowatts and the remaining 109 had an average connected load of 8.17 kilowatts. It is probably safe to assume that no customer having a connected load of less than 4 K. W. or less could get along comfortably throughout the winter in even a small house without additional heating facilities, while an average connected load of 8.17 kilowatts would serve to heat the average house, assisted, perhaps, by a little additional heat from stove, furnace or fireplace during the most severe winter weather. The 103 customers having an average demand of 8.17 K. W. roughly represent those whose entire heating requirements during 1919 were taken care of electrically, whereas the remaining 44 used auxiliary heating apparatus to a greater or less extent.

The following heating data, taken from the 1919 report of the Lighting Department, contain additional information with reference to the 1919 electric heating load.

TABLE 1.—HEATING DATA FOR TACOMA FOR 1919.

Number of customers, Dec. 31, 1919	547
Income from all customers (378 for only part of year)	$19488.25
Probable income if all were served the whole year	$36,000.00
Total connected load of all customers, December 31, 1919	3625 K. W.
Number of customers served for full year	139
Income from customers served for full year	$9268.40
Total connected load of full-year customers	923 K. W.
Average annual income per kilowatt of load	$10.00
Consumption by full-year customers	1,778,238 K. W.
Average rate per kilowatt hour	$0.0052
Number of customers using over 4 K. W. a full year	103
Total connected load of full-year customers using over 4 K. W.	842
Average load of customers using over 4 K. W.	8.17 K. W.
Average load of all 547 customers	6.65 K. W.

THE 1920 HEATING LOAD.

The heating business for 1920 shows considerable increase over that for 1919. A point of interest is the fact that the average rate per kilowatt hour sold increased from 0.522 c. to 0.557 c., or 1.1%, the schedule of rates remaining unchanged. The increase in the average selling price above ½-cent rate results from the operation of the $9.00 minimum. The tendency is to install sufficient heater capacity to take care of the coldest weather conditions. This often leads to the installation of heater capacity considerably in excess of that required for average winter weather and results in the minimum charge for the year exceeding the charge based on the straight kilowatt hour consumption.

In connection with Table 2 containing a summary of the heating data for 1920, the largest single customer was a theatre

TABLE 2—HEATING DATA OF TACOMA, 1920.

ITEM	CLASS OF CUSTOMER			
	Residence	Apartment	Business and Miscell.	Total
Number of customers	795 or 86%	54 or 5.8%	76 or 8.2%	925
No. of full year customers	377 or 89%	15 or 3.6%	31 or 7.4%	423
Total kw-hr. consumption	7,207,600 or 81.3%	396,360 or 4.5%	1,256,000 or 14.2%	8,860,000
Average kw. consumption per customer	9075	7340	16,500	Average=8580
Total kw. connected load	5141	307	656	6104
Average kw. connected load per customer	6.47	5.68	8.63	6.60
Total income	$39,812.00 or 80.6%	$2,298.00 or 4.6%	$7,290.00 or 14.8%	$49,400.00
Average annual income per customer	$50.10	$42.50	$96.00	$53.00
Average annual income per kw. conn. load	$7.90	$ 7.50	$11.10	$ 8.09
Average rate per kw-hr. sold	0.552c	0.579c	0.581c	0.557c
No. customers using 4 kw. or more a full year	271	10	24	305
Total conn. load of full year customers of 4 kw. or over	2274 kw.	75.5 kw.	236 kw.	2585.5 kw.
Average conn. load of customers using 4 kw. or over	8.38 kw.	7.55 kw.	984 kw.	8.48 kw.
Average income for year per customer using 4 kw. or over	$81.00	$92.00	$132.00	
Total income from customers using 4 kw. or over a full year	$21,973.00	$919.87	$3,168.87	$26,061.75

TABLES 3 AND 4—MONTH BY MONTH CONSUMPTION BY RESIDENCE CUSTOMERS, 1920.

375 Full-year Residence Customers
Average connected load=6.28 kw.

MONTH	KW-HR. CONSUMPTION		PER CENT YEARLY TOTAL	ACTUAL AVERAGE COST
	TOTAL	AVERAGE		
January	669,000	1785	14.1	$ 9.81
February	643,000	1715	13.5	9.30
March	625,000	1665	13.2	9.19
April	550,000	1467	11.6	8.07
May	332,000	885	7.0	4.87
June	241,000	642	5.1	3.55
July	119,000	317	2.5	1.74
August	49,500	132	1.0	0.70
September	132,000	352	2.8	1.95
October	303,000	808	6.4	4.45
November	492,500	1310	10.3	7.17
December	593,600	1582	12.5	8.70
Totals	4,749,700	12660	100	$69.50

278 Full-year Residence and Apartment Customers using 4 kw. or over.
Average connected load=7.80 kw

MONTH	KW-HR. CONSUMPTION		PER CENT YEARLY TOTAL	ACTUAL AVERAGE COST
	TOTAL	AVERAGE		
January	570,800	2070	13.9	$11.35
February	565,600	2050	13.8	11.30
March	530,200	1920	12.9	10.50
April	479,600*	1740	11.7	9.50
May	282,900	1025	6.9	5.60
June	212,900	772	5.2	4.60
July	105,200	380	2.6	2.10
August	43,800	159	1.0	0.90
September	109,500	396	2.7	2.20
October	257,600	932	6.3	5.10
November	422,000	1530	10.3	8.40
December	522,100	1890	12.7	10.30
	4,102,200	14864	100	$81.85

having a connected load of 152 K. W., consuming a total of 291,840 K. W. hours for the year, and costing $1,459.20.

COMPARISON OF MONTH BY MONTH CONSUMPTIONS.

Tables 3, 4, 5 and 6 give the month by month consumptions, the yearly totals and the average costs of energy for four classes of residence customers, as indicated. Table 3 represents an average of practically all full-year residence customers using electric heat throughout the year 1920. Table 4 gives the results of a study of all residence and a few apartment customers who heat entirely or nearly so by the electrical method. In many cases some additional heat is supplied by means of a kitchen range or a fire-place during the coldest weather.

The costs for electric energy given, therefore, probably do not represent accurately the full amounts of the average heating bill for the customers involved. However, this error is partly compensated for by the fact that a considerable number of the customers listed in this table also have electric water heaters connected to the heating circuit.

Table 5 summarizes the data for 18 typical full-year residence customers most of whom use auxiliary heat during the coldest winter weather. Of these customers, 9 used wood or coal ranges in the kitchen, 3 used small heaters in the kitchen, and one used a furnace at times during the coldest winter weather. The remaining five had no auxiliary heat except that derived from fuel burned in the fire-place. Nine customers cooked with wood and gas ranges, 6 with electric ranges and 3 with gas.

The average number of rooms per residence was 5.8 and the average number of persons per family was 3.3. Further data show that the average yearly consumption for this class of customers is about 13,600 K. W. hours, costing the consumer approximately $78.75.

It is a noteworthy fact that these customers paid an average of $78.75 per year each, for 13,642 K. W. hours or at the rate of 0.576 c. per kilowatt hour. Had they reduced their connected load sufficiently to take advantage of the ½-cent rate without penalty, the average bill would have been only $68.71. Only one customer out of nearly 50 interviewed complained of the service.

CONSUMPTION OF ELECTRIC FURNACE PLANTS.

Table 6 summarizes the consumption of a limited number of consumers representing the highest development in the complete electrification of the home. Practically all consumers of this class not only have their homes completely electrified, but have eliminated the portable electric heater as well, and have substituted in its place a central electric heating plant, or electric furnace, located in the basement, which supplies either hot water or hot air to the various rooms in much the same way as does the ordinary hot water or hot air coal-burning plant. These plants are illustrated in Figs. 2, 3 and 4.

At the present time there are installed in Tacoma residences about 50 such plants. Of these the great majority are hot air plants, a few are hot water plants and a few use electrically-generated low-pressure steam. Many of them have operated through one winter season only and therefore could not be included in Table 6.

When comparing the consumption of these customers with that of the average customer, Professor Leow states that one must not overlook the fact that these installations are usually found in the homes of those whose houses are above the average in size and convenience. Furthermore, these usually include an electric water heater connected to the same meter with the furnace circuit, of an average capacity of perhaps 3 K. W., the consumption of which is included in the values given in the table.

The average yearly consumption during 1920 of the customers listed was about 28,500 K. W. hours, including water heater,

TABLES 5 AND 6—MONTH BY MONTH CONSUMPTION BY RESIDENCE CUSTOMERS, 1920.

Consumption by 18 typical full year residence customers interviewed who use some auxiliary heat during the coldest winter weather.

Average connected load=7.85 kw.

MONTH	KW-HR. CONSUMPTION		PER CENT YEARLY TOTAL	ACTUAL AVERAGE COST
	TOTAL	AVERAGE		
January	36,392	2020	14.8	$11.65
February	31,167	1730	12.7	10.00
March	33,085	1836	13.4	10.55
April	28,560	1580	11.6	9.13
May	17,408	966	7.1	5.60
June	17,158	953	7.0	5.51
July	4,750	264	1.9	1.50
August	1,143	63	0.5	0.40
September	5,263	292	2.1	1.65
October	15,199	845	6.2	4.90
November	25,806	1433	10.5	8.26
December	29,910	1660	12.2	9.60
Total	245,841	13642	100	$78.75
Average		1138		$ 6.56

*These figures include cost of heating water for hot water supply.

Consumption by 7 residence customers using hot air electric furnaces throughout the full year.

Average connected load=10.85 kw.

MONTH	KW-HR. CONSUMPTION		PER CENT YEARLY TOTAL	ACTUAL AVERAGE COST
	TOTAL	AVERAGE		
January	29,200	4170	14.6	$21.45
February	27,700	3960	13.9	20.35
March	28,980	4140	14.5	21.30
April	24,232	3460	12.2	17.80
May	12,952	1850	6.5	9.50
June	8,965	1280	4.5	6 60
July	2,885	410	1.4	2.10
August	3,982	570	2.0	2.95
September	4,145	590	2.1	3.05
October	11,653	1660	5.7	8.55
November	20,235	2890	10.1	14.85
December	24,710	3530	12.4	18.15
Total	199,639	28510	100	$146.65*
Average				$12.20

and cost the consumer $146.65, or about $12.20 per month. The customers interviewed expressed themselves uniformly as greatly pleased with their heating plants, as well as with the service derived from them.

The largest single residence consumer occupied a 14-room house, and with a connected load of 39.9 K. W. consumed 82,400 K. W. hours during 1920, for which he paid $412.00. Radiant-type heaters distributed throughout the house were used for the most part, although one or two water induction-type heaters, attached directly to water radiators, were also employed. The hot water supply for the house was furnished by electric heaters, while cooking was done by gas. The family consisted of three members and two servants.

TOTAL ENERGY CONSUMPTION FOR COMPLETELY ELECTRIFIED HOME.

Professor Leow segregated the total energy requirements of a completely-electrified home to determine the costs at the rates given. The classes of service requiring electrical energy are roughly the following:

1. Electric lights and small household appliances, including electric iron, electric washer, vacuum cleaner, toasters, etc.

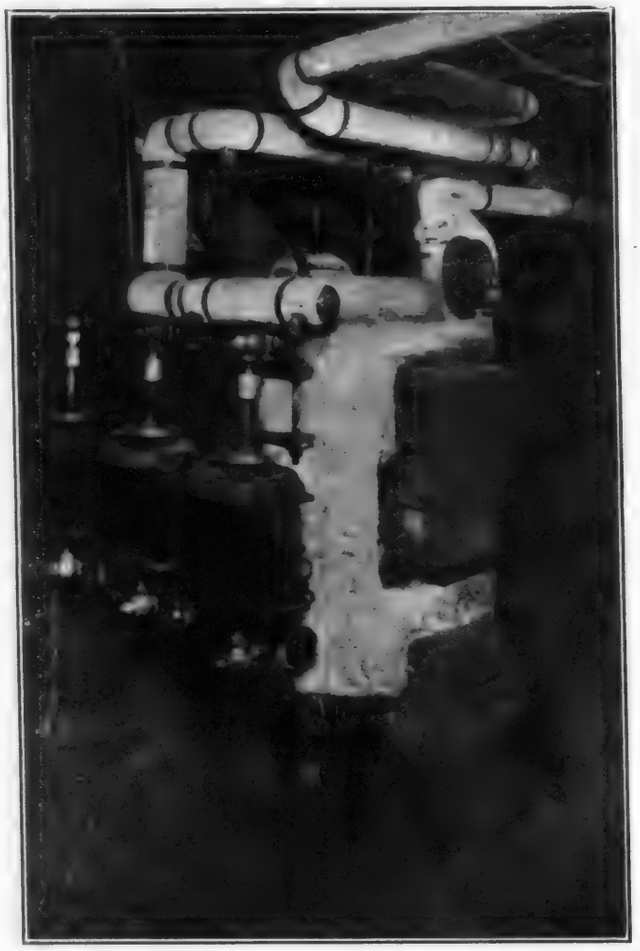


FIG. 4.—HOT WATER INDUCTION-TYPE ELECTRIC HEATING PLANT AND COAL-BURNING WATER BOILER INTERCHANGEABLY CONNECTED.

2. Electric range.
3. Electric water heater.
4. Electric furnace.

The consumption by electric lights and small appliances in the average home is approximately 25 K. W. hours per subscriber per month, while the average electric range consumption is about 125 K. W. hours per month. The consumption by electric water heaters is, perhaps, subject to more variation than that of either range or lights, for it depends not only upon the size of the family and their varying habits, but differs considerably for different types of heaters, as well as with the care with which the hot water tanks and piping are heat insulated. When a flat rate is in effect, a low wattage heater, operating more or less continually, is used, while when a meter service is provided, as is the case in Tacoma, the average heater is of from 2 to 3 K. W. capacity and is often provided with thermostatic control to switch it in or out automatically.

An analysis of the consumption by 25 range and water heat consumers in Tacoma shows an average consumption of 385

FIG. 5.—RESIDENCE ELECTRICALLY HEATED WITH A WARM-AIR FURNACE. CONNECTED LOAD—11 K. W. ENERGY CONSUMPTION FOR 1920 WAS 32,780 K. W. HRS., COSTING $163.90.

K. W. hours per month for this service. Deducting 125 K. W. hours per month for range consumption leaves 260 K. W. hours per month for the water heater. Assuming the average electric furnace consumption, including water heater as that given in Table 6, or 2376 K. W. hours per month, the monthly consumption chargeable to the furnace alone is 2116 K. W. hours.

If we assume a six-room house to represent the average residence, the "lighting base" according to the company's combination rate schedule is approximately 33 K. W. hours per month. Keeping in mind that the electric lights and range are connected to a second meter and are charged the ½-cent rate with a $9.00 per year minimum, we may set down the assumptions and corresponding costs as follows:

1. Electric lights and appliances.....	25 K. W. hours per month, av.
2. Electric range	125 K. W. hours per month av.
Total	150 K. W. hours per month av.

33 K. W. hours @ 5 c. = $1.65
117 K. W. hours @ 1 c. = 1.17

Average monthly cost for lights and range, $2.82.

3. Electric water heater.....	230 K. W. hours per month, av.
4. Electric furnace.....	2146 K. W. hours per month, av.
Total	2376 K. W. hours per month, av.

2376 K. W. hours per month at actual cost shown in Table 6 is $12.20, making a total average cost per month for electric energy of $14.90, or a yearly cost of $178.80.

The curves shown in Fig. 6, which were plotted from data obtained from nineteen consumers having furnace plants and based on their December consumption of current, clearly show how closely the energy consumption follows the outdoor temperature. By dividing the monthly energy consumption by the average difference in temperature between out-of-doors and

68° F. for a given month, a figure is obtained which represents the kilowatt hours per month per degree temperature below 68° for a given class of consumers. This figure is fairly constant for all months except the summer months, during which the energy consumption is small, and is of value when making comparisons of energy consumptions for varying temperature conditions. The yearly average K. W. hours per degree temperature above 68° is 162 for the above customers having furnace installations; the average for the six fall and winter months is 163 and for the six spring and summer months, 161.

SUMMARY.

From the foregoing the following conclusions seem warranted:

1. Where electrical energy is developed from a water power plant, particularly one having no water storage and where considerable amounts of surplus power or seasonal power are available, the available surplus may find a ready market if sold for house-heating purposes. Experience indicates that electrical energy sold at ½ cent per kilowatt hour will readily compete with coal at $9.00 per ton.

2. The climatic conditions to which the data given apply are mild, as indicated by the fact that the mean outdoor temperature for the year 1920 was about 51° F. Under these conditions, with electrical energy at ½ cent per kilowatt hour:

(a) An average six-room house having a wood and coal range or a small auxiliary heater in the kitchen may be heated comfortably with a connected heater load of about 8 K. W. at an annual cost of $75.00 for electrical energy.

(b) An average six-room house using radiant-type heaters in the rooms to be heated may be heated comfortably with a connected heater load of about 10 K. W. at an annual cost of $110.00 for electrical energy.

(c) An average seven-room house using an electric furnace may be heated comfortably with a connected heater load of about 12 K. W. at an annual cost of about $145.00 including hot water requirements.

3. The energy consumed in house-heating is directly proportional to the difference between indoor and outdoor temperatures. The month by month percentages in terms of the yearly totals are given in the curve of Fig. 6. These percentages, of course, apply specifically to the climate conditions prevailing in Tacoma during 1920.

4. Subject to the limitations of the data available, one may conclude that the energy consumption per cubic foot of volume per annum required to comfortably heat a house is about 2.35 K. W. hours for Seattle and Tacoma. Likewise the consumption per cubic foot per annum per degree difference of temperature (outdoor temperature minus 70°) is 0.131 K. W. hours.

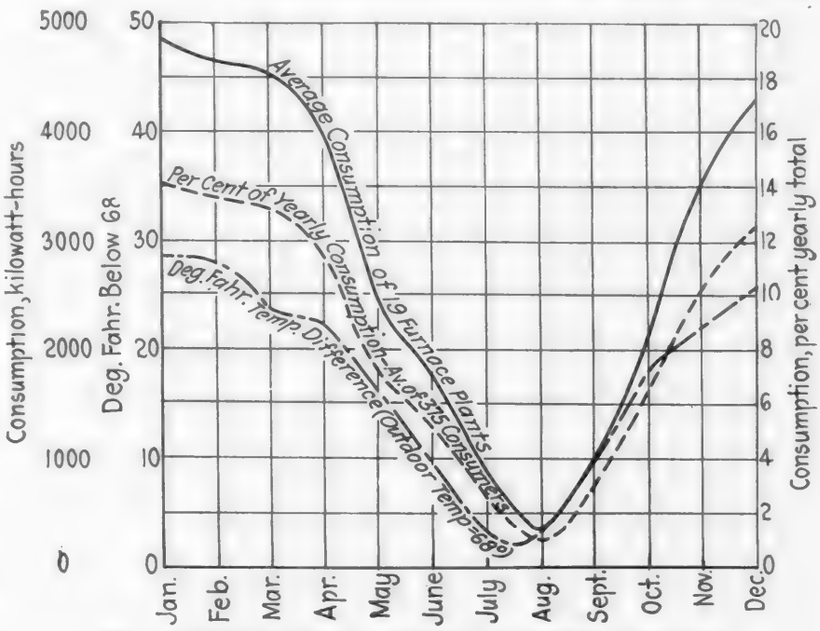


FIG. 6—PERCENTAGES OF ENERGY CONSUMED IN HOUSE-HEATING, AS AFFECTED BY THE WEATHER.

WHY ELECTRICAL HEATING IS NOT LIKELY TO BECOME GENERAL IN TACOMA.

In view of the approximate equality between the cost of heating by coal and electricity at present prices of coal, and because of the much greater convenience and desirability of the electrical method, the question naturally arises, will the increasing use of electricity for heating continue in Tacoma until it completely replaces coal as a fuel in the home? There are a number of sides to this question.

1. It is to be remembered that the coal prices during the winter of 1920-1921 were at their peak following the war, and that they had already receded somewhat and will in all probability decline further during the next few years. If the price of coal should go to $9.00 per ton, the cost of heating electrically, as compared with coal, would then be roughly one and one-half times as much, which would at once tend to check the growth of the heating load.

2. As previously pointed out, the efficiency of heating by means of electric heaters located in the space to be heated is 100%. Therefore no improvement in the efficient use of electric energy for house heating is possible when a radiant heater is used.

3. The plant capacity which would be required to supply domestic power alone to Tacoma residences would be very large.

4. To develop electrical energy for this purpose from steam is also out of the question for unless electric energy can be developed from coal at an over all thermal efficiency, including transmission to the consumer's home, approximating the overall efficiency of a house furnace plant, domestic heat will be furnished by coal burned in the home rather than in a central power plant. The maximum thermal efficiency possible in the best steam plants is roughly 20%. From this must be subtracted distribution losses, etc., so that the maximum thermal efficiency which would be possible by heating electrically from energy generated in a steam plant is under 20%, while by consuming fuel in furnaces in the home, 40% energy efficiency is ordinarily obtained, and 60% or 65% efficiency may be obtained as a maximum. Thus the energy efficiency secured by the latter method is from two to three times as good as that of the former.

In view of the foregoing it is apparent that there is little present likelihood of the general adoption of electrical heating. However, as already pointed out, the City of Tacoma, by offering electric energy at a low enough figure to permit of its use for electric heating has, with very little added expense, given the home owners the benefit of energy which would otherwise have been wasted; the city has been able to do this to date without in any way denying the use of power for other purposes which may be considered to have a first claim since their energy requirements cannot be readily or efficiently furnished from coal; and in so doing the city has been able to show a profit during the four years 1918 to 1921 inclusive, (the profits for the last four months of 1921 being estimated) of over 80% of the original cost of the whole hydroelectric plant, including transmission line and substations.

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IT will come as a pleasant surprise to many to learn that Charles P. Steinmetz has joined the ranks of the heating and ventilating experts. This does not mean that he has in any way abated his interest in the electrical field, but has simply applied his unique talents towards the solution of the problem of economical heating. His concrete ideas on the subject are expressed in the current issue of the *Graphic Survey*, under the title of "The White Revolution." Dr. Steinmetz first calls attention to the well-known fact that if our coal supply should last for hundreds of years, some day it will be exhausted. "What then?" he asks. "Will civilization come to a standstill and man lapse back into barbarism? Or will other sources of power be found?" He answers this by calling attention to the great source of energy available through the water powers of the country.

"But how much energy," he continues, "is available in the water powers of the country? Is it enough, when coal is exhausted, to supply the power demand of civilization?"

The total available water power in the United States, he points out, has been variously estimated at from 50,000,000 to 100,000,000 horsepower. He then makes the significant statement that even though this is a vast amount of power, it is just about the total which we get out of our present coal consumption for all purposes—power, light, heat, metallurgical work and so on. Thus we see that the total water power of the country, even if it could all be developed, would be only just enough to replace our present coal consumption, leaving nothing for future increased needs of power. This, he observes, is rather unexpected because people have always hoped that in the future, when the coal will have been used up, the water powers of the country will take the place of coal. But we know already that all the water powers of the country would not be enough.

WITH the foregoing as a preface, Dr. Steinmetz has the following unique proposals to make in the heating of houses:

"In heating houses we really use more than ten times as much coal as necessary. We could save nine-tenths of it, but we probably will not do so until forced to it by a failing coal supply, for to save would require a radical change of building construction. There is, for instance, a great waste of heat in the gases going through the chimney. There is a waste of heat through walls and doors and windows. But the greatest waste is due to our present inefficient methods of ventilation. We must have sufficient ventilation. That is, we must let the foul air out and take in fresh air. In most private houses we do this in a haphazard fashion by periodically opening some door or window. In large buildings we have properly-arranged ventilating systems. In either case, however, we throw out the warm foul air and take in cold fresh air, and so over and over again we have to heat new masses of fresh air and all this heat is thrown away in the foul air which we exhaust. Usually over 90% of all the heat from our furnaces is lost. Although we must replace the foul air with fresh air, there is no reason why we should throw away with the foul air all the good and valuable heat which it contains, and not supply from it new heat to the fresh air.

"If it were properly arranged, we should take the heat out of the foul air before we exhaust it, turn it into the incoming fresh air, and so heat the incoming cold air by the heat of the outgoing warm air. This recovery of the heat is called a regenerative system of heating. We could do this by passing the outgoing warm air around the outside of the pipes which bring in the fresh air, and so warm the latter by the former. Then all the heat which our furnaces would have to supply would be that lost through the walls, doors and windows. By proper building construction this loss could be made slight, so that a very small amount of heat would warm the house—so small indeed, that it would be economical to heat houses electrically, economical to own a house without a chimney, even though the price of electric energy must always remain many times greater than the price of coal containing the same amount of energy."

While Dr. Steinmetz's proposal is not exactly new, his comments, nevertheless, will arouse fresh interest in a point which is rapidly becoming the most vital of all in the mechanical ventilation of buildings.

IDLENESS in some fields of engineering, it is reported, is operating to open up new spheres where the engineer is finding a place. In one case, for instance, it was learned that department stores which traditionally have been regarded as foreign to the engineering field, are offering possibilities in connection with cost methods, simplification of mechanical systems and personnel. There is a thought here of more than passing interest to the heating profession which has long experienced the difficulty of having plants operated in accordance with their design.

SERVICE DEPARTMENT

Trouble With Water-Logged Pipe Coils.

QUESTION: We are enclosing sketch of a gravity steam heating system in a public garage. The sketch shows the piping for the south wall of the building, the north wall being an exact duplicate except that the coils are connected direct to the riser, eliminating the 50 ft. or more of overhead steam main. Our main trouble seems to be with the water coming out of the air valves and the coils moving forward. We should be pleased to have you recommend some method to correct these faults. We should also like to know if using traps, instead of checks, would make it a more satisfactory job. If so, how deep should the seal be? Any other change you might point out to improve the condition will be greatly appreciated. The steam pressure carried is about 5 or 6 lbs. and the bottom of the coils is 5 ft. above the water-line of the boiler.

ANSWER: There are a number of things which might contribute to the difficulties cited, such as size and drainage of pipes, location of air valves, elevation of coils above boiler water-line and the use of check valves.

The size of the return should be 2-in. or 1½-in. instead of

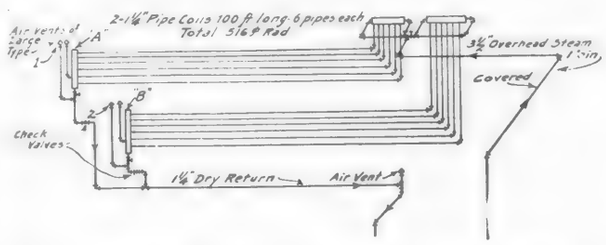


FIG. 1—STEAM HEATING COILS WHICH DISCHARGE WATER FROM AIR VALVES.

1¼-in. As a wet return, 1 in. would not be too small; but as a dry return its area should be sufficient to pass steam as well as condensate. This requires a pipe of much larger size, since steam occupies about 1600 times as much space as when condensed.

The size of pipes in the coils should also be taken into account. Considering their great length, 1¼-in. pipes are small, thereby making the friction surface large in proportion to the volume. Pipes of this size and length tend to sag and form pockets in which core sand, scale, etc., accumulate.

LOCATION OF AIR VALVES.

Better results might also be obtained by locating the air valves at points A and B (Fig. 1). Connections to side of branch tees could still be retained, if found necessary, but the air valves 1 and 2 are of no use and should be eliminated. In any event, the proper location can be determined and air binding eliminated by noting which of the pipes are cold and which are hot.

Short and large connections to air valves are more desirable since the greater the length, the greater the condensation occurring directly within them. Steam condensed takes the line of least resistance which, for the given conditions, appears to be out through the air valves, not back and counter to the velocity of escaping air. The air valves close against water, it is true; but only with sufficient quantity of condensation entering from the coil. Particularly is this so with large quick-venting float-type traps.

HOW CHECK VALVES SOMETIMES CAUSE TROUBLE.

Sand and scale collecting at check valves may keep them from opening wide or closing tight so that condensation is retained. Also steam from the return is liable to enter through the

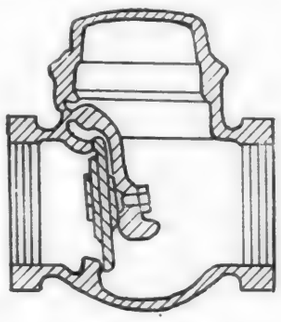


FIG. 2—CHECK VALVE WITH FREE AREAWAY.

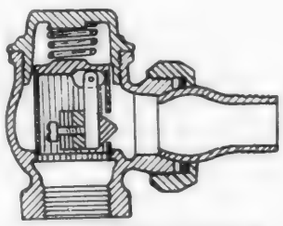


FIG. 3—ANGLE IMPULSE VALVE.

partially-opened check and close the air valve of one of the coils before all air has been eliminated. This can be readily determined by noting which of the coils heat up first.

A check valve has its uses, but it will not prevent water-logging unless the head of water is greater than the difference in pressure each side of the check. Such a valve not only collects sand, as previously stated, but also offers considerable resistance to the flow of steam due to its interior web or diaphragm. For this reason, it is advisable to use a type similar to those shown in Figs. 2 and 3. By using the latter, in place

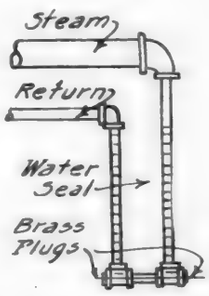


FIG. 4.—TYPICAL WATER SEAL FOR END OF STEAM MAINS.

of an elbow, the resistance to flow is greatly decreased; and with either of these valves, but very little energy is required to swing the disc.

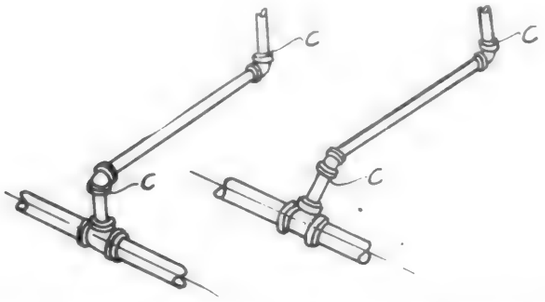
Steam traps, properly adjusted and maintained in working condition, prevent full steam pressure in the return and might be helpful if back pressure is working against either one of the coils. Back pressure will still remain but its effect will be decreased.

THE USE OF WATER-SEALS.

A wet return is always preferable to a dry return. Almost any one will use a wet return, if conditions permit, since it is then impossible for steam to enter the coils from the return. However, such advantages may be obtained even in a dry re-

turn, provided there is sufficient head room between the steam and return main. This may be done by making a rise in the return pipe so as to establish a false water-line and water-seal the whole return. A "balance pipe" is then connected to the steam main and to the rise of the return main for the purpose of admitting steam to the top of the riser, thus breaking any tendency to syphonic action which might otherwise occur.

The depth of seal necessary is determined by the difference in pressure existing at that point (Fig. 4). It is usually made about 2 ft. in depth for each pound difference in pressure, but need not be quite as deep if used at each branch connection, instead of sealing the entire return. The less difference is caused, of course, by the fall in pressure of the steam while passing through the coil.



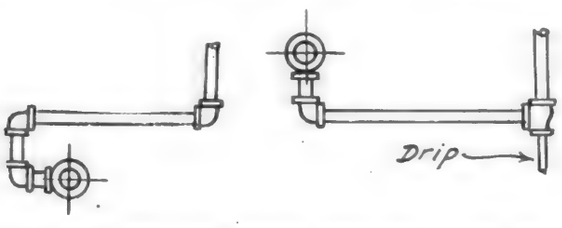
FIGS. 5 AND 6.—METHODS OF CONNECTING BRANCHES.

PROPER ELEVATION OF RADIATION ABOVE WATER-LINE OF BOILERS.

Friction losses from steam flowing through pipe and fittings is a very important consideration. This pressure loss results in a material difference in pressure and rise of water above the normal water-line of the boiler, especially when the piping system is quite extensive or where the pipe sizes are too small. To this must be added the natural drop in pressure due to the steam condensing in the pipes and coils.

In the present case, the bottom of the coils is 5 ft. above the water-line. This seems ample, but if the main air valve on the dry return discharges water and the lower coil holds up water before the upper, it is doubtless the real cause of the difficulties.

The weight of a vertical column of water is 0.43 lbs. per square in. for each foot of height. Thus, 1 lb. drop in pressure

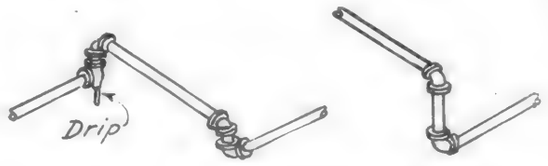


FIGS. 7 AND 8—BRANCH CONNECTIONS WHICH PROVIDE FOR EXPANSION OF STEAM MAIN.

will cause the water to rise 2⅓ ft. in the return or 0.43 x 5 gives 2.15 lbs. as the allowable drop in pressure. If the drop is greater than this, as shown by the difference in reading between the steam gauge on the boiler and another on the return, it is conclusive proof that the coils are not placed at a sufficient elevation to return the water against the pressure in the boiler. This is more fully explained in the January number of THE HEATING AND VENTILATING MAGAZINE (p. 50).

PROVIDING FOR EXPANSION IN THE PIPING SYSTEM.

If the coils move forward it is due to water-hammer or expansion of the piping system when first heating. Doors left open for any length of time will also contribute to the movement by allowing cold air to pass directly over the coils; but,



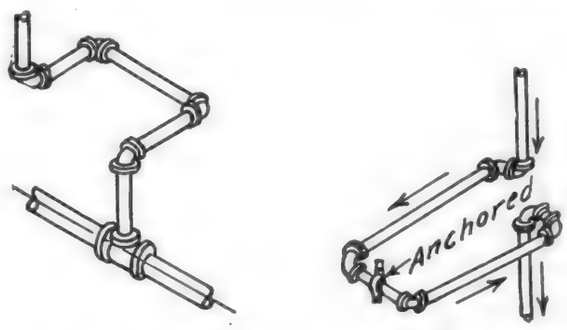
FIGS. 9 AND 10.—EXPANSION SWIVEL JOINTS.

unless leakage takes place at pipe joints, it is difficult to see just what harm is caused by this action.

The coils may be anchored, of course, and expansion joints provided at proper points—say, at the top of the riser or at the end of the overhead main. Coils 100 ft. long will expand 1½ in. if heated from 52° to 232° F., while the steam main will move about ¾ in. for the same range of temperature.

In the case of pipe coils, it is customary to take care of the elongation by means of spring pieces. However, in Fig. 1, the upper coil is shown with only a slight vertical extension as compared with the lower coil. Something is wrong here, since for steam coils 100 ft. long, the length of the shortest piece in the spring piece should not be less than 5 ft.

There are various methods of providing for expansion of pipes, the selection of which depends upon the conditions in mind. Allen and Walker in "Heating and Ventilation" show quite a number. For instance, in Figs. 5 and 6, as the main moves longitudinally, the threaded joints of the ells turn slightly. Fig. 6 is a somewhat better arrangement since a 45° ell offers less resistance to the flow of steam than a 90° ell.



FIGS. 11 AND 12.—FLEXIBLE CONNECTIONS FOR RISERS.

The arrangement shown in Fig. 7 is sometimes used when the expansion of the main is very great. However, its use introduces a number of fittings which increase the resistance to flow. Fig. 8 is somewhat similar and is used where a drip connection is required, but it is also open to objection, since water may rise in the return and seal the riser from the main.

In long mains the movement is too great to be taken care of by means of branch connections. Swivel joints are then provided as shown in Figs. 9-12 and the main anchored at two or more points. This method necessitates the use of extra fittings; also, in Fig. 10, part of the expansion must be absorbed by the spring of the members.

In small buildings of about four stories, expansion of the risers may be taken care of by the spring of the branches and by turning of the tees connecting the branches to the main (Figs. 5 and 6). However, in large buildings—say, eight stories—the arrangement shown in Fig. 11 should be used. For taller buildings, the risers may be anchored near the middle as shown in Fig. 12, so that expansion can take place in both directions.

Factory Ventilation Requirements in Australia

In recent years the question has arisen whether the basis of factory ventilation, or any other ventilation, for that matter, should be the recording of the percentage of saturation of the air, or the wet-bulb readings alone.

What is described as a still more satisfactory method is that introduced by John L. Bruce of Sydney, Australia. In a paper on the general subject of the lighting and ventilation of factories, presented by J. S. Purdy before the Australian Association for the Advancement of Science, the Bruce method is discussed at length.

Mr. Bruce, states the author, found that while a wet-bulb temperature of 70° or 75° F. is not oppressive when the dry bulb is 80° or 90°, yet when the air is fully saturated and there is no evaporation—that is to say, when the dry and wet-bulb temperatures are identical—a temperature of 70° is very oppressive, and a temperature of 75° almost unendurable, most muggy and oppressive.

Mr. Bruce found that a wet and dry-bulb thermometer based upon a constant dew-point gave comfortable and desirable conditions at all dry-bulb temperatures in New South Wales. So long as the dew-point did not rise much above 62° F. the conditions were not unpleasant. Even with a very high dry-bulb temperature, bodily vigor was not impaired. With a dry-bulb of 111° and a wet-bulb of 82°, but with the dew-point only 66°, hard work was done without discomfort, although the air was burning hot; whereas, with a dry-bulb of only 77° and a wet-bulb of 75°, but with the dew-point 73.5, the conditions were depressing.

PERMISSIBLE DRY AND WET-BULB TEMPERATURE IN AUSTRALIAN FACTORIES.

The table of permissible dry and wet-bulb temperatures in the New South Wales Factories Act of 1909, as fixed by Mr. Bruce, was based upon a minimum dew-point of 57° and a maximum of 67°. This gives a mean dew-point of 62° F., at which temperature saturated air is neither muggy or chilly. When the dew-point is from 70° to 75°, exertion becomes difficult, but with the dew-point near 62°, even with high wet and dry-bulb temperatures, work can be carried on without inconvenience.

Mr. Bruce's records show that the comfortable and invigorating conditions of temperature in relation to moisture in the air are indicated by the dew-point rather than by any mere indication of the wet-bulb or of the dry-bulb alone. By lines drawn from the dry-bulb thermometer scale to the wet-bulb scale, in such a way that when the mercury in the dry and wet-bulb thermometers is at the level of the corresponding ends of the line, a dew-point of 62° is indicated on an instrument designed by Mr. Bruce and made by Mr. Esdaile, Hunter Street, Sydney. By this instrument the ordinary individual can record comfortable conditions of temperature and moisture, and can regulate mechanical ventilation in certain industries and factories in accordance therewith.

The Factories Act requires that in every factory in New South Wales the means of ventilation, warming and cooling, to be provided and maintained, shall be such as to keep the humidity and temperature of the air during working hours within the proportions of temperature in relation to moisture shown in Table 1. The relative maximum temperatures of the wet-bulb thermometer must never be exceeded within the factory or shop except when the humidity in the fresh open air surrounding the factory or shop is so excessive that it shows an increase in those relative temperatures. On such occasions the wet-bulb temperature within the factory may be increased in the same proportion as that shown by the open air. If for any special manufacturing process or storage purpose any occupier desires the air in his factory workshop to be saturated with moisture beyond the proportions shown by the relative temperatures given in Table 1, he must make written application to the Minister for special permission to do so, specifying the conditions as to temperature and moisture which he desires.

TABLE 1.—RELATIVE DRY AND WET-BULB TEMPERATURES REQUIRED BY THE NEW SOUTH WALES FACTORIES ACT.

Dry-Bulb Thermometer	Corresponding Wet-Bulb Thermometer Showing Humidity in Air	
Deg. F.	Minimum	Maximum
40	35	37
50	44	47
60	53	53
65	60	61
70	63	68
72	64	69
75	65	70
80	67	73
85	68	73½
90	69½	74
95	71	75
100	73	76
105	74	77½
110	75	78½
115	76½	80
120	77½	81

EXCEPTIONAL CONDITIONS IN A TOBACCO FACTORY.

The only case of exemption under the Factories Act in New South Wales, in which the relative maximum temperature of the wet-bulb thermometer is permitted to be exceeded, is in a large tobacco factory. This factory, one of the most up-to-date in Australia, with a large amount of window space, requires for manufacturing purposes an even, moist temperature. In hot weather, when northwest winds prevail, windows can be freely opened, but when the dry, westerly winds are blowing, the means of ventilation cannot be fully utilized, as the leaf becomes too dry to handle readily.

Readings taken by Miss Harriott, senior inspector, with a wet and dry-bulb thermometer, showed that the humidity of the atmosphere in the "rolling" department slightly exceeded that allowed by the Factories Act. In this case a certificate was given permitting the company to vary the temperature of the wet-bulb in the "rolling" department, so long as it did not exceed by more than 3° the temperature indicated in the regulation.

RULES FOR NATURAL VENTILATION

For natural ventilation the rule is generally laid down that openings for the exit of foul air should average 24 sq. in. for each individual. Where the openings for fresh air are larger than those for the exit of foul air, and are placed 5 or 6 ft. from the floor, possibilities of draft are minimized. Hitherto, sufficient use has not been made of the natural ventilation obtained by leaving a space between the upper portion of the wall and the roof of buildings. It is a good rule, in factories, to invest one person with the responsibility of seeing that windows are kept open and of prohibiting the closing of windows except to prevent rain or dust from driving into the room. With this proviso, in most cases natural ventilation should be sufficient, except on days with relatively high humidity, when it is necessary to supplement it by mechanical movement of the atmosphere, as by electric fans.

The difficulty of ventilating factories, largely due to the accumulation of pockets of foul air, especially toward the center of large rooms, can only be entirely satisfactorily removed by mechanical means, the best of which appears to be a combination of the plenum and vacuum systems. Where there is special risk from dust, fumes, or gases, owing to the nature of the employment, strong exhausts and hoods are necessary at the points of production.

LEGAL DECISIONS

Patent for Radiator Shield Held Valid.

The Circuit Court of Appeals, Eighth Circuit, Lodermann Heat & Power Co. v. Kauffman, 270 Fed. 593, holds valid the Kauffman patent, No. 1,170,544, for a radiator shield, (reversing 267 Fed. 435) for the following reasons: A new combustion of old devices, which increases the efficiency of old machines, or if a new useful result is produced, or even an old result in a more facile, mechanical, useful or effective way, may be the subject of a valid patent. While the evidence in the case justified a finding that the patentee's device is a combination of old elements, it was also held to justify a finding that a new result was produced by his device, more efficient than any heretofore known, to deflect, by the use of the shield in the device, the dust particles arising from the radiator, into a trough, also a part of the device, where they will be retained and protect the walls and ceilings from the black dust and smoke arising from the radiator. Although the lithic top would not of itself be patentable, it would be patentable, in the absence of older patents, prior use, or other legal anticipations, in connection with the brackets adapted to be placed at the ends of the radiator, by being provided with inwardly extending flanges, and the trough above the radiator to collect the dust particles.

Contract for Installing Heating System Held Not to Include Duties as to Setting Boiler.

In an action to recover the contract price for installing a gravity-return steam-heating system (except boiler and burner) in the defendant's office building and factory, the contract provided that the supply pipe should run from the top of the boiler horizontally to a point near the end of the office building, and, dropping down, pass through a tunnel in the basement of the main building and rise to the roof of that building; and that the return pipe should pass through the tunnel to the boiler. After the boiler was set and connections were made, it was found that the water line was but 6 inches or less below the main steam pipe, so that when the water in the boiler was heated sufficiently to produce the necessary steam pressure, water passed from the boiler into the pocket made by running the main steam pipe through the tunnel. The pocket being filled with water, it was impossible to force steam into the main building, and the steam pressure against the water in the pocket caused hammering. The defendant remedied this defect by drawing the water from the pocket through a small pipe into a tank by the side of the boiler from which the water was pumped by an electric pump back into the boiler. To install this extra equipment cost the defendant $1.135, which sum it contended should have been deducted from the plaintiff's bill.

The Rhode Island Supreme Court, Cameron & Ingalls Engineering Co. v. Providence Body Co., 114 Atl. 1, directed judgment for the plaintiff for the amount claimed for the following reasons:

The contract for setting the boiler was given to another contractor. The plaintiff's only duty in respect to the boiler was to connect it with the rest of the heating system and with the water supply. The written contract was complete in itself. No explanation was necessary to make clear its terms or provisions. The defendant could not, therefore, add a new provision requiring the performance of additional duties. Moreover, the testimony showed that any services of the plaintiff's engineer in determining the depth of the boiler pit amounted merely to gratuitous advice on a subject which the defendant with little effort could have secured information, and did not warrant any inference that the plaintiff assumed any responsibility therefor.

Unavoidable Loss of Steam and Hot Water in Mains.

In a proceeding for increase of rates for steam-heating and hot water service to the Springfield Gas & Electric Company, the Illinois Public Utilities Commission found, in considering a protest by certain consumers that the company had allowed the mains to fall into a bad state of repair, that the operating data of the company showed that there was lost between the station and the consumers' premises less than 10% of the steam put into the mains, a figure which tended to show that the steam-heating system was in exceptionally good condition. Steam losses in the mains by condensation are unavoidable, and a loss of 10% by this means alone showed an efficiency much greater than the average heating system can be expected to attain. This tended to prove that there could be little if any steam lost by leakage from the mains. If the hot water mains were in a bad state of repair, there would be much water lost by leakage. The record showed that the amount of water necessary to offset the leakage loss was small and had not been increasing from year to year. Furthermore, the operating accounts of the two heating utilities did not show heavy charges for maintenance and repair to the distribution systems. It was therefore held that the allegation as to bad repair of the mains was not supported by the facts.

Damages Arising from Heating Installation Contract.

In the following case neither party received the satisfaction asked for, either in the trial or the appellate court. It would seem, however, that a somewhat heavy burden was placed on the contractor to foresee damage to the player piano on the upper floor.

Action was brought in the Kansas courts to recover the balance due on a contract for installation of a heating plant in the defendant's house. The defendant counter-claimed damages and judgment was rendered in her favor. The plaintiff appealed. The defendant also appealed from disallowance of certain items of her counterclaim.

The contract contained a guaranty that the heating plant would meet certain requirements. In an unsuccessful effort to demonstrate the efficiency of the plant, the plaintiff caused the furnace to be heated intensely. In an unsuccessful effort to make the plant warm the house, the defendant also caused the furnace to be heated intensely. It was then discovered that a player piano, standing in a room above the furnace room and at a place directly over the furnace, had been injured by the overheating. The defendant was allowed damages for injury to the instrument, and the plaintiff contended the damages were too remote. The Kansas Supreme Court, however, Kansas Hardware Co. v. Freeman, 198 Pac. 711, was of opinion the damages resulted proximately from breach of the contract. The plaintiff also urged that the defendant might have prevented injury to the piano by removing it to another place. It was held that the defendant was not obliged to anticipate that the furnace could not be made to fulfill the purpose for which it was installed without injury to the instrument. As soon as the injury suffered was discovered, further damage was prevented by employing a man to overhaul the plant.

The contract provided that the plaintiff would do certain excavating in the furnace room, and would furnish the labor

and material necessary to install the plant. In order to install the plant, it was necessary to remove several feet of basement wall, which furnished support for the building to be heated. The plaintiff removed the wall, but did not restore it. Afterwards the building settled, and the defendant claimed damages for injury to the building. The contract did not require the plaintiff to restore the wall. It was not claimed that the plaintiff was guilty of any negligence, and it was held that if the defendant desired the wall replaced she should have rebuilt it at her own expense.

It was also held that the trial court properly disallowed an item of the counterclaim relating to extra coal used in trying to make the plant heat the house, because definite evidence was not produced from which the quantity of extra coal could be computed.

The judgment of the lower court was affirmed.

CORRESPONDENCE

The "Ready-to-Serve" Charge in Steam Heating.

EDITOR HEATING AND VENTILATING MAGAZINE:

The publication of the interesting article entitled the "'Ready-To-Serve' Charge In Steam Heating," by Malcolm C. W. Tomlinson in the February issue of your magazine leads me to comment on certain phases of the subject which seem to have been lost sight of.

The primary purpose of a "ready-to-serve" or demand charge is to distribute equitably among the consumers that portion of the cost of service which is proportional to the demand and which may amount to nearly 50% of the total cost of service in some cases. Any radiation formula or other means of calculating the demand is only accurate insofar as it represents the true demand of the building. Now does the required radiation, as figured by the N. D. H. A. rule or any other rule, really represent this demand? The amount of radiation in the building is calculated to maintain a predetermined temperature under certain weather conditions. The maximum demand for steam, however, if the steam is shut off at night, depends on the extent to which the building is cooled and on the rapidity with which it is attempted to warm it. For example, consider a building which, for the purpose of warming it up quickly, is provided with a considerable excess of radiation over the amount required to maintain its temperature when continuously heated. Would the actual maximum demand, in such a case, be proportional to the amount of radiation required to maintain the building at a constant temperature of 70°?

The following is a list of five buildings on which half-hourly readings were taken throughout the day on January 3, 1920, when the outside temperature reached a minimum of 0°. The required radiation was computed by the B. T. U. method.

	Maximum demand per square foot of required radiation
Building No. 1	0.342 lbs. per hour.
2	.238 lbs. per hour.
3	.420 lbs. per hour.
4	.243 lbs. per hour.
5	.226 lbs. per hour.

A readiness-to-serve charge has many recognized advantages. It serves to stabilize the income of the heating company, making it partially independent of weather conditions, and helps to distribute the cost of service more equitably; but it should not be taken for granted that a demand charge, figured by means of a radiation formula, necessarily represents the true demand of the building or that discrepancies in the results obtained through the use of various formulae are the only serious deviations from the true figure.

J. H. WALKER,
Superintendent of Heating,
The Detroit Edison Company.

Detroit, Mich.

"What Is the Matter with Hot Water?"

EDITOR HEATING AND VENTILATING MAGAZINE:

May I be allowed to reply to Mr. Reginald Gordon's letter in your January issue, concerning my recent article on "What's the matter with Hot Water"?

Your correspondent asserts that the development of steam heating has been brought about by the extreme severity of your northern climate.

Personally, I am inclined to think the reason is rather to be found in the fact that hot water has never been given a proper chance in America.

The statement that steam is the more suitable medium to take care of peak-loads requires some substantiation. The fundamental disadvantage of this system is its inelasticity, it is "all or nothing." If designed for 70°—0°, it overheats the rooms at 10° outside, and under-heats them at —10°. The pipe sizes (it all turns on this factor) are only suited to the pre-determined working pressure for which the plant was designed.

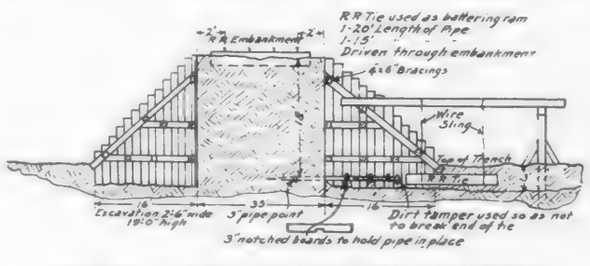
It is quite different with hot water. The circulation can be maintained with varying boiler temperatures of from 120° F. to 220° F. A hot water plant calculated for 70°—0°, with 180° boiler flow and 25% margin in power, can easily be run up to produce 70° internal when the outside falls to nearly —20° F. This is precisely where hot water has the advantage—*properly understood*.

F. BROADHURST CRAIG.

London.

A Pipe Line Shortcut Through a Railroad Embankment.

By driving a pipe line through a railroad embankment, instead of tunneling, interruption of train service is avoided as well as progress of the work. A good battering ram for this purpose is an old railroad tie. This may be hung with four strands of No. 10 galvanized-iron wire from a 4-in. by 6-in.



DRIVING A PIPE LINE THROUGH A RAILROAD EMBANKMENT.

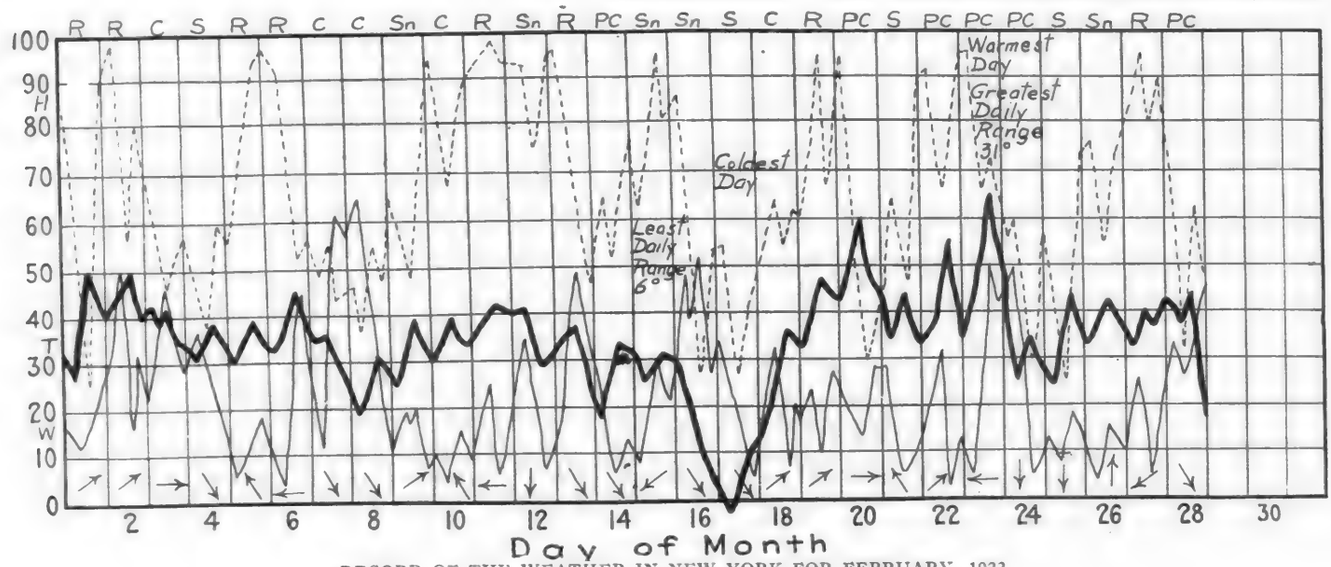
lumber frame, and made to swing so as to strike against a dirt tamper as slipped in the pipe for protection of the pipe end.

For the conditions as shown in the sketch, a 3-in. by 15-in. piece of pipe pointed at one end is coupled to a 20-ft. length of the same size. The pipe is then laid on a 2-in. by 8-in. lumber cradle, the three members of which are notched and placed at suitable intervals to give the necessary direction. After driving is finished a second length of pipe, 15 ft. long, is coupled to the first., and the work of driving continued.

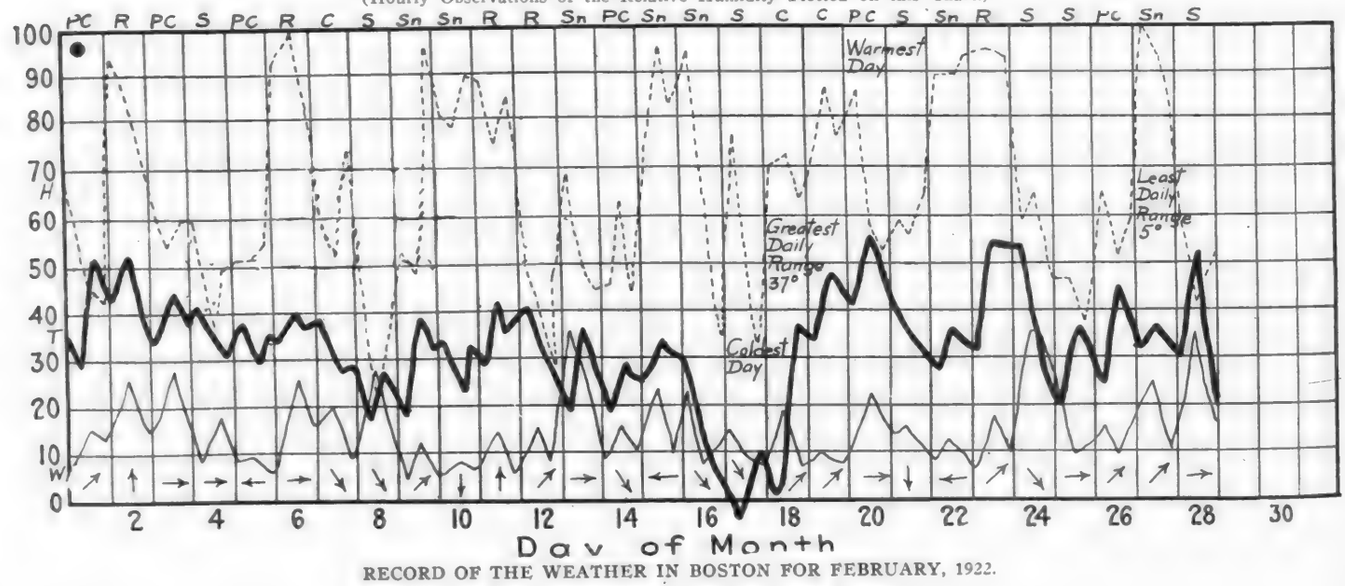
Three men can do a job of this kind in six hours.

THE WEATHER FOR FEBRUARY, 1922

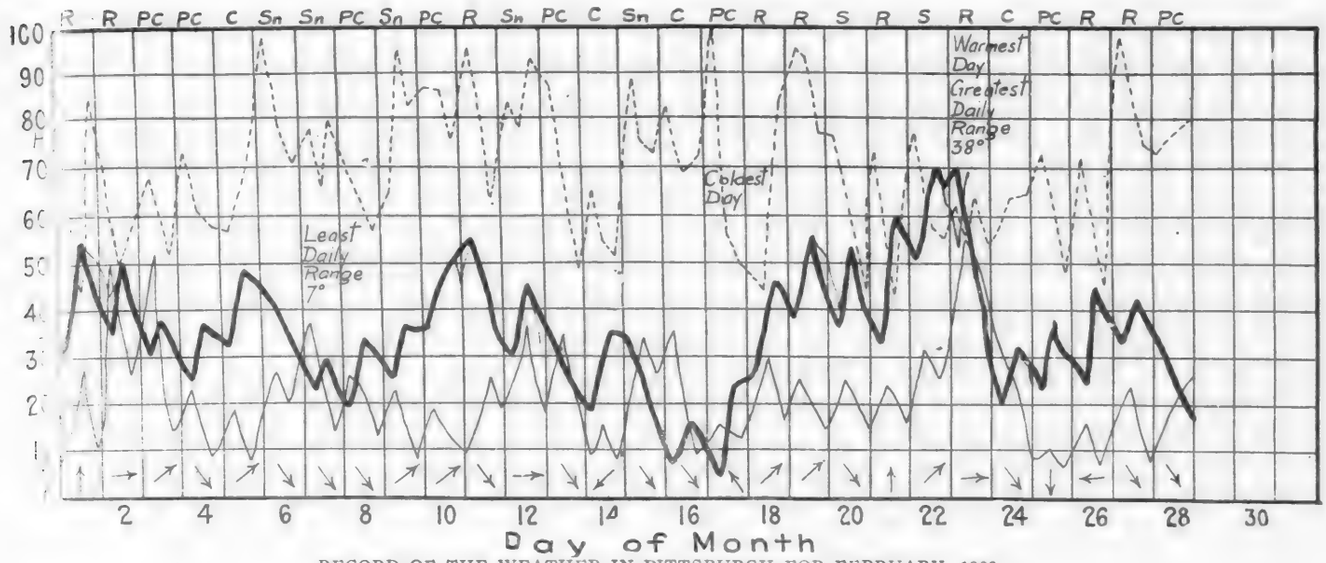
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F.	66	56	70	68	74
Date of highest temperature	23	20	23	22	22
Lowest temperature, deg. F.	—2	—4	5	2	12
Date of lowest temperature	17	17	17	16	7
Greatest daily range, deg. F.	31	37	38	38	31
Date of greatest daily range	23	18	23	23	21
Least daily range, deg. F.	6	5	7	7	5
Date of least daily range	15	27	7	26	26
Mean temp. for month, deg. F.	34.5	32.1	35.2	29.4	36.4
Normal mean temp. for month, deg. F.	30.7	28.0	31.8	27.4	34.5
Total rainfall, in.	2.97	2.64	1.57	0.74	1.52
Total snowfall, in.	8.0	15.1	3.4	0.9	0.8
Normal precipitation, this month, in.	3.74	3.44	2.66	2.16	2.75
Normal snowfall, this month, in.	10.1	12.2	7.4	9.6	...
Total wind movement, miles	12692	6634	8900	9552	10054
Average hourly wind velocity, miles	18.9	9.9	13.2	14.2	15.0
Prevailing direction of wind	N. W.	W.	N. W.	W.	S.
Number of clear days	5	7	1	7	6
Number of partly cloudy days	10	5	6	6	11
Number of cloudy days	13	16	21	15	11
Number of days on which rain fell	8	5	9	4	2
Number of days on which snow fell	5	7	5	5	2
Snow on ground at end of month, in.	None	Trace	None	Trace	0.7



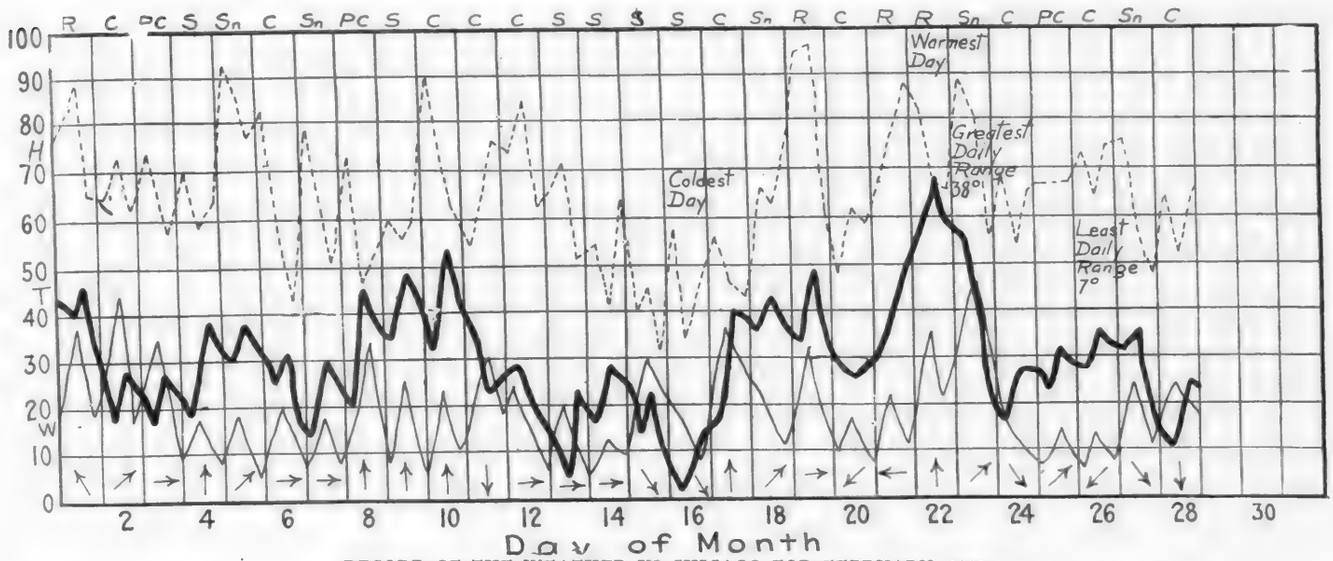
RECORD OF THE WEATHER IN NEW YORK FOR FEBRUARY, 1922.
(Hourly Observations of the Relative Humidity Plotted on this Chart.)



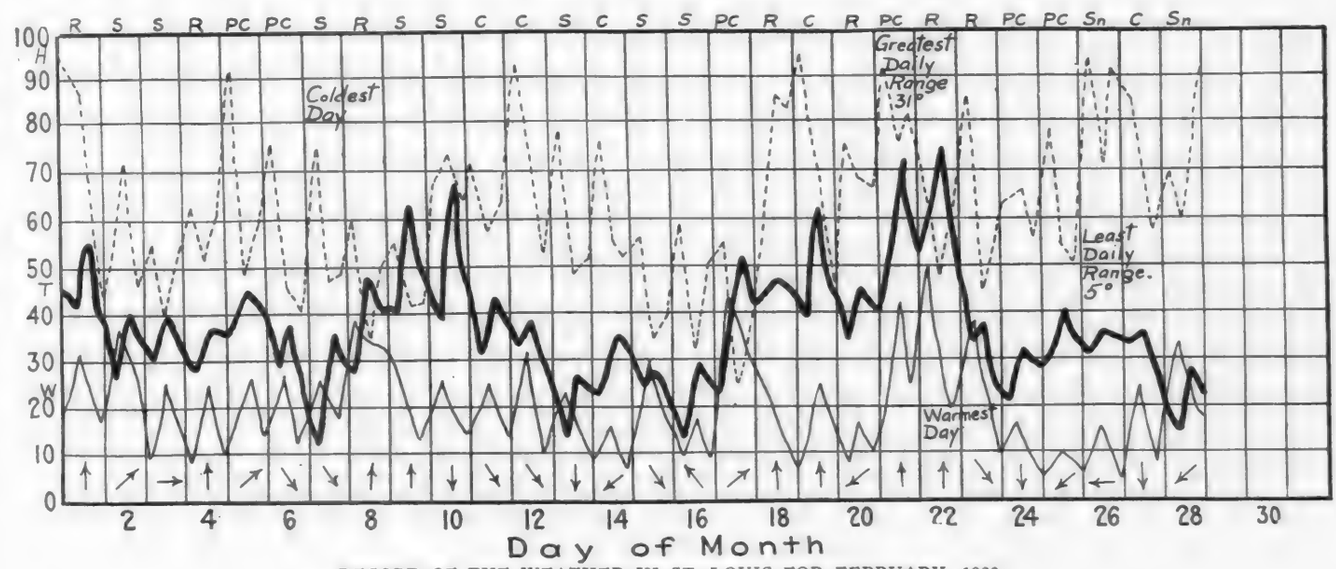
RECORD OF THE WEATHER IN BOSTON FOR FEBRUARY, 1922.



RECORD OF THE WEATHER IN PITTSBURGH FOR FEBRUARY, 1922.



RECORD OF THE WEATHER IN CHICAGO FOR FEBRUARY, 1922.



RECORD OF THE WEATHER IN ST. LOUIS FOR FEBRUARY, 1922.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken line indicates humidity in percentage from readings taken at 8 a. m., 12 m., and 8 p. m.
S—Clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing directions of wind.

THE MOVEMENT IN FRANCE TO ESTABLISH HEAT RESEARCH LABORATORIES

BY W. P. MITCHELL.

A few master minds among French economists and technicians have just held a convention and exhibition of heating appliances and combustibles in Paris. Monsieur Kling of the Municipal Laboratory has set forth most convincingly the need of France getting in line with other modern nations and paying vastly more attention to the problem of heat engineering than in the past. His views are set forth, in part, herewith.

To begin with, of an annual consumption of coal for all purposes before the war of 60 million tons, one third was imported from Germany, England and Belgium. Today the production in France is but half of the total; to be exact, in 1921, but 29 million tons metric.

Most Americans in France before, during and since the war have complained of the inadequacy of heating arrangements in homes, hotels, offices and factories. It is all a question of what a sufficient, or at least adequate, temperature may be. Apart from this it is suggested that much depends upon the introduction and general adoption of something considerably more efficient in heating appliances before conditions will improve, or the temperature rise.

The international radiator organization, various German installations before the war (and they are coming back) and others of Swiss origin have already made an impress, sometimes even in the larger provincial towns as well as Paris, but the domestic establishment in general, wherever found, is still manifestly and unhygienically, heated.

A temperature of 60° F. is rarely found even in a Riviera hotel, where, as the saying goes, it is generally climatically too warm for a fire and too cold to be without one. The average bourgeoise French family lets it go at the former and economically cuts out all forms of domestic heating except on ceremonious occasions, or gives so little that what fuel is used may be considered downright waste, which is not economy at all.

To no small extent the same is true of office and factory. I write of the small middle-class establishment in each case, though the same may more frequently than not be found to apply to something of more magnificent proportions. But it is in the small and middle-class family and in the small plant, shop or office where those who perforce labor therein need to be as well warmed as well nourished in order to meet the pace of competitive livelihood. Few in France have ever thought of it this way, but there seems to be a well defined movement at last shaping itself.

FRANCE'S COAL RESOURCES DWINDLING

It is readily computable, for France above all, a future not so very far away when its coal resources will be exhausted. A rational manner of using this resource naturally imposes itself upon the country at large. The same applies to many other countries, less so, fortunately, to America than any other. As for Italy, almost alone among great modern nations, more vividly than any other, there is practically not a pound of coal to be dug from its soil, in spite of a statement in a popular and widely-read American paper recently, written by a "popular" author, to the contrary. The situation for France is perhaps slightly better, but a half a century should see the deposits drawing to their rock bottom if new ones are not discovered, as indeed they are to a minor extent in the south of France today. The situation, however, is deemed sufficiently serious to compel immediate attention.

HEAT RESEARCH WORK IN FRANCE, GERMANY AND ENGLAND.

It is for this reason that France is seeking to found an organism which shall in some measure correspond to the Bureau of Mines and the Bureau of Standards in America which shall have the competency and the means for carrying out research to the end that the best, most appropriate and most efficient, results shall be obtained for the use of combustibles. In Germany there is already in function the Kaiser Wilhelm Coal Institute, very richly endowed and England has two organizations to the same end, the Coal Consumers' Committee and the Committee for Economy in Combustibles.

France, less favored than any of the nations where such mediums are already in operation, is bound, today more than ever, to take an interest in this vital question. Actually there is no institution in France taking upon itself the study of the problem in all its phases. There are, however, certain bodies of a semi-private nature, which, even in the spirit of the most genial altruism known to the business world, are unlikely, indeed are not called upon, to make public the results of their researches. The chief among these are the Experimental Station of the Comité des Houilleres and the laboratories of certain of the big metallurgical firms, such as Creusot, Homècourt et al., working, all of them, in their own proper interests. Finally there is an institution known as the Office of Rational Heating, a specialized and quasi-closed compartment organization.

Treating of these matters officially in France there exists the Commission of Combustibles of the Ministry of Public Works, presided over by the Prefect of the Seine (Paris) whose functions are to make known to the inhabitants of the department the best means of getting the best results from the combustible put at their disposition.

It is for this reason that the recent convention, or congress, was called at Paris with a view to realizing on the agitation for the immediate founding of a body which shall have the means and capacities of its personnel available to carry on the important work which its charter shall lay down—rational use of combustibles, by and for whatever purpose.

This organism will be in direct dependency of the Bureau des Mines but with a modern viewpoint which, perhaps, in the course of time will get the inadequate, extravagant mining concession laws of 1810, which are still in force, amended, a costly first step to begin with, but one which will produce enormous dividends in the long run.

This project is in accord with the conclusions arrived at at the International Chemical Congress held at Brussels in 1921, which adopted the principle of national laboratories for the study of combustibles and ceramic products. At this congress it was decided that appeal should be made to private industry for the founding of the laboratories in countries where none exist at the present time. A permanent standing committee will shortly meet in Paris to carry out the realization of this project.

OUTLINE OF RESEARCH PROGRAM.

The plan of action, according to Monsieur Kling, who is to be the chairman of the forthcoming Paris international congress is announced as follows:

"Create a current of opinion favorable to the idea, a crusade which shall make known the truth concerning the necessity of prompt action to prevent all waste in combustibles of whatever form and used in whatever manner."

For France the question of urgency is most apparent. Known resources of coal in the ground are but 8 billion tons, Germany has 40 billion tons and England 300 billion tons.

VALUE OF AVERAGE INCOME REDUCED MORE THAN ONE-HALF.

The need of something more and better in the way of heating appliances than those in use in France is more apparent than ever as the following budget figures will show. Where can the French go better than to the American manufacturer and heating engineering firms to get that which they lack? The trouble is they don't know this; very few American heating appliances and the knowledge that such even exist are known, least of all by the father of the family, who, for the most part, still keeps his family, and himself in his home, very much underheated indeed.

The figures which follow were given me by a French government official. They tell the story.

One man's salary is 25,000 francs, before the war the equivalent of $5000, at which time he paid the equal of $120 for heating and cooking fuel. Today his normal income remains the same, but its value is but $2,000 and he is paying $480 for fuel. This indicates the relative situation of most French families. Give them some inclusive method of central heating, by radiators, furnace, calorifère or what not, and the fuel bill will come down. This is not a question of the extension of a philanthropic idea, merely one of business expediency, even necessity, for those who can see it.

JUST WHAT WE MEAN WHEN WE TALK ABOUT BACTERIA

Although ventilating enginers talk glibly of bacteria and what their presence in the air means, it is not always realized just what constitute these minute organisms. Some interesting comments on this subject are contained in an article on "Ozone and Bacteria" by William J. Lohman, of the Ozone Air Purifier Company, written in collaboration with P. W. MacMillan.

"Far down in the scale of living things," he writes, "and, in fact, at the very bottom, so far as we know, there exists a vast aggregation of infinitely minute organisms which are variously called bacteria, microbes, germs, micro-organisms, etc. They assume many forms and their reactions and methods of reproduction vary greatly, but the study of their life histories constitutes the basis of the science of bacteriology.

"Bacteria are not animals, but plants, and consist of a single cell, being the simplest structure possible in any living thing. This cell is composed of a mass of albuminous matter called protoplasm, surrounded by a membraneous sack of proteid mater resembling cellulos or wood fiber.

"Although bacteria are plants, they are unable to produce their own food from inorganic matter after the fashion of those higher vegetables with which you are familiar. It is, therefore, necessary for them to obtain their nourishment from dead or living organic matter. In the first instance they are known as saprophytes, in the latter as parasites. Certain types of bacteria which are natural parasites may, through force of necessity, lead a saprophytic existence for a long time. In like manner certain species may become parasites.

"A very marked example of this characteristic to accommodate themselves to dead conditions is presented in the typhoid organism. By nature it is a parasite choosing as its habitation the intestinal tract of warm-blooded animals. Yet the typhoid bacillus may live many weeks frozen in solid ice and is frequently found in contaminated water, dust, milk, vegetables and in the ground that has been infected. Certain types of bacteria are parasitic to only one kind of animal as, for instance, the disease known as anthrax in sheep and glanders in the horse. These specific organisms may, with great difficulty, be transmitted to other animals, but their natural hosts are best suited for their development.

BACTERIA NOT ALL HARMFUL.

Of course, not all bacteria are harmful. Were it not for certain species of bacteria all life of every kind would disappear from this planet. The continued existence of our food supply depends upon them. Nature demands that after death all things which have lived upon the earth's bounty shall give back to the earth that which they took from it during life. This law governs humanity just as inexorably as it does the blade of grass. The fall leaves, trees and branches would soon choke our forests to death were they not attacked and destroyed by bacteria which cause them to decay and through this decay convert this waste matter into food for the survivors. Imagine, if you can, the condition of this earth if all decay were to suddenly cease. Picture to your minds the awful condition of this earth one hundred years hence if all things that die were to undergo no physical change after death.

"Without bacterial action, we could not produce a loaf of bread or any other food requiring yeast, as yeast is a form of bacteria. Neither could we manufacture beer, wine, alcohol or vinegar, as these are all products of bacterial action. Let us now examine these bacteria closer and see how they live and reproduce themselves.

"As was said in the beginning, they consist of a simple cell. In size they are so small as to almost baffle description.

"A high-powered microscope using a 1/25 in. oil immersion lense gives a magnification of 22,000 diameters, and under this power, bacteria appear about the size of ordinary newspaper type. The average man viewed under similar magnification would appear over four miles high or higher than Mount Blanc. I might put it in still another way: If we accept the bactrium as the smallest of living things and a full grown elephant as the largest, the common house fly would be just midway in point of size. In other words, there is just as much room on a house fly for bacteria as there is on an elephant for the house fly. It would be well to remember this fact next time a fly takes a high dive into your cream pitcher.

REPRODUCTION OF BACTERIA.

The reproduction of bacteria takes place in two ways; by fission and spore formation. Fission is a process of transverse division whereby an organism divides into two parts each of which thereafter leads a separate and independent existence, and these in turn divide again into two and so on. Spore formation is akin to the production and liberation of seeds in the more familiar plants, but of course, takes place much more rapidly. The rapidity with which this bacteria develop and multiply varies with different species and is in all cases profoundly affected by the nature of the medium in which they occur as well as by condition of temperature, moisture, light and air. Under ideal conditions fission or subdivision may take place every fifteen minutes. Under less favorable conditions it might require several hours.

With reference to the incredible rapidity with which bacteria multiply under favorable conditions let us assume that an organism divides into two within an hour, then again into eight in the third hour, and so on. The number of bacteria thus produced from a single individual in twenty hours would exceed 16,500,000. In two days they would increase to 47 trillions and in a week a number expressing them would be made up of fifty-one numerals, and cannot be expressed mathematically.

As to their volume at the end of twenty-four hours, the bacteria descended from a single individual would occupy 1/40 of a hollow cube whose size measures 1/25 in. At the end of the second day, they would fill a space of 27 cu. in., and in less than five days their volume would exceed that of the entire Atlantic Ocean. As to their weight, a single bacterium weighs about 672 quadrillionths of a grain. Forty thousand million would weigh one grain, and two hundred and eighty-nine billions would weigh a pound. After twenty-four hours, the descendants of a single bacterium would weigh 1/2,600 part of a grain. After two days, over a pound, and after three days, 7,366 tons. It is hardly necessary to state that these figures are purely theoretical and could be realized only if there were no impediment to such rapid increase. Fortunately, various checks such as lack of food and unfavorable physical surroundings prevent unmanageable growth.

Bacteria come under the head of organic matter and are composed of about 86% water and 14% solid matter, of which a little more than one-half is carbon. When a bacterium is exposed to ozone in a high concentration, the carbon is instantly reduced to carbonic acid gas, and the organism is absolutely annihilated. Ozone in high concentration does not simply kill bacteria, it literally removes them. But in ventilation high concentration must not be used.

"Bacteria during their process of generation produce various poisonous compounds known as toxins. The bacteria themselves have no power to do any harm but the toxines produced by them are what cause all of the trouble in an infectious disease."

Bureau of Mines Publishes Reports of Investigations

In order to present to the public more promptly the results of its scientific investigations, the Bureau of Mines has begun issuing a series of brief mimeographed "Reports of Investigations" as an adjunct to the printed publications. Besides affording a medium of prompt publication of information, the "Reports of Investigations" provide a vehicle for the publication of briefer material which would hardly justify issuance in the form of printed bulletins.

These reports deal with major metals, minor and rare metals, non-metallic minerals, petroleum, gasoline, coal, coke, safety, sanitation, mine accidents and other subjects. The reports are mailed free to interested applicants as long as the editions are available. Descriptive notices of issues in the series are mailed regularly to all who desire to receive the information.

Serial 2316, just issued, is a subject list of "Reports of Investigations" issued to December 31, 1921, and describes some 300 reports, whose range

covers such subjects as abrasives, automobile exhaust gases, breathing apparatus, carbon black, fuller's earth, liquid oxygen explosives, mine telephones, oil pipe lines, slate dust, valuation of oil properties, airplanes in mine-rescue work, powdered coal, helium, mine timbers, lead poisoning, smoke prevention, clays, building stones, safety in quarrying, etc., etc. Serial 2316 may be obtained from the Bureau of Mines, Washington, D. C.

NEW EFFORT TO ERADICATE AN OLD ABUSE

How the heating and plumbing contractors of Rochester, N. Y. are attempting to eliminate such clauses in heating specifications as that requiring contractors to guarantee the successful operation of heating systems; also to secure better co-operation generally on the part of the architects in preparing such specifications, is brought out in a circular letter which is being sent to the architects and engineers of Rochester by the Rochester Master Plumbers and Steam Fitters' Association. The principal portions of the letter, which was drawn up by a committee headed by William F. Devendorf, are given herewith:

"We are living at a time when the development along all lines of endeavor is exceedingly rapid. We do not recall that advances have been more rapid or more sweeping in any branch of the building trades than they have been in the heating industry.

"It is true that steam has been used as a heating medium for a great many years and that water has been used also, but for a considerable less period. Nevertheless the advances made since the advent of the one-pipe gravity return steam heating system are almost as great as was the advance of the one-pipe system over the old 'base burner.' One must be well informed indeed today to be familiar with the many vapor systems and the countless devices by means of which the modern heating plant is made so effective and so efficient.

"The manufacturers of boilers and radiators have kept pace with the inventors of so-called 'specialties' until today we have updraft boilers and downdraft boilers in both steel and cast-iron and we have numerous boilers of the smokeless variety which may or may not be downdraft or crossdraft.

"A great deal of time has been devoted to the proper design of the piping layouts for different types of systems. A vacuum system requires a much different design from the so-called vapor systems. Again each vapor system has its own design, particularly adapted to its most successful operation.

"There are several types of water heating systems, the open-tank system, the closed-tank system and varieties of each, with basement main or overhead supply piping systems, etc.

"The number of different systems of damper control on the market to-day is astonishingly large and no two makes of boilers have the same damper arrangement.

"Whether a building should be heated by steam, water or vapor has been the subject of many a controversy. If vapor is decided on, then which of the numerous systems should be used? Why is water best for some types of buildings and steam for others? Should the boiler be cast-iron, steel, updraft, downdraft, smokeless, brickset, portable or whatnot?

"We wish to make the statement, and in view of the above, we believe you will agree with us, that the selection of the proper type of heating plant and then the proper design of the type selected is not a matter of small moment. We believe that no other part of the building equipment is so important. Certainly on no other depends to so large an extent the comfort of the people, who must spend a large share of their time within the walls of a building, be it house, office or factory.

"We have been led to believe that possibly the advances made, as we have so briefly indicated, are not fully appreciated. We are sure they have not been by the great buying public.

"The improvement and refinement and the inevitable complications have, we find, run ahead in many cases of the understanding of the user. The ordinary user still thinks that a heating plant is a simple and entirely automatic thing and that once installed it should run along without repairs or special attention. It seems to be one of the penalties of our advancing civilization that as we advance, the means by which we live become proportionately complicated. We must be able to understand these complications. It is, for instance, amazing when we consider the thousands who have become sufficiently familiar with automobiles, not only to operate them but to adjust and repair them. To have refused to accept automobiles because they were enormously more complicated than the lumber wagon would seem ridiculous.

"We might as well make up our minds that heating systems will not become simpler but rather more complex and we must be ready to meet the situation.

"The Associated Master Plumbers and Steam Fitters of Rochester want the assistance of the architects and engineers of Rochester in advancing the art of heating and particularly in its application. Practices have grown up which, while adequate in the past, are not, we believe, to be commended now. Some of these practices result in much duplication of effort with its consequent waste.

THE PRACTICE OF SPECIFYING RESULTS AND QUANTITIES.

"It has been the practice in some cases, even by engineers and architects of standing, to not only specify performance results but also to specify quantities. This, it seems to our association, is not fair to the contractor. It would seem to us that where quantities and dimensions are specified in detail, the responsibility for results must of necessity rest with the party who specifies the quantities. The contractor should be perfectly willing to guarantee his material and his labor but is it fair to ask him to guarantee results of performance, when he has had no voice in the design? We believe the reasonableness of this position has only to be stated to be appreciated.

"The architect or engineer is familiar with his building design as his contractor cannot possibly be, and if he designs the heating system he shoud, better than anyone else, know the needs to which the heating system will be subjected. He knows the type of construction, how well the walls are insulated, their thickness, the quality of material entering into the building and all the other factors which affect the capacity of the heating plant. Very often the floor plans only are given to the contractor. It is obviously impossible in this case for him to know whether or not he can fulfill a certain guarantee with all the quantities specified.

"The conclusion forced upon us is that where the architect or engineer specifies the vital quantities (such as size of boiler or size of mains or size, number and location of radiators) he should not ask the contractor to guarantee room temperatures but only to guarantee his workmanship and material. We believe further that the more or less frequent practice of specifying minimum quantities with the requirement that if the contractor does not deem the amounts sufficient to meet the guarantee, he must agree to increase the amounts sufficiently to meet the guarantee at no expense to the owner, is harmful and should be discontinued. We do not believe that such a saving clause is worthy of the best traditions of the architectural profession.

"In many cases architects have admitted that they are not heating experts and only general requirements are given in their specifications, such as the kind of system and the temperatures desired. While this practice is not subject to the comment in the previous paragraph we know that it leads to much dissatisfaction. No two bids will cover the same quantities or the same layout and it is very difficult to fairly compare figures. The owner is incapable of judging the relative merits of the different proposals and only too often the matter degenerates into a price contest which is disastrous to all concerned. Our suggestion in cases of this kind would be for the architect to hire a competent engineer to write the heating specifications. In this way responsibility is definitely placed, all contractors figure on the same basis and the owner knows what he will get. By a competent engineer, we mean an unprejudiced, reputable engineer of recognized standing. The cost of such a service should not be great and we know of no other expense which is so fully justified.

"The above consideration, of necessity, will direct our attention to the practice, now so largely prevalent, of the writing of specifications and the preparation of plans by the manufacturers of specialties. At this time we will not go into the matter at length. There are many reasons why this practice has grown up and there are many obvious reasons why the practice might be criticized. If we might make a suggestion in this case, it would be similar to the previous one, namely, that a competent unprejudiced expert should pass on the design.

"In some cases plans and specifications are prepared by wholesalers, jobbers and manufacturers' representatives. This practice we condemn and believe that everything possible should be done to eliminate it.

"The Associated Master Plumbers and Steam Fitters' whole idea in making these suggestions is to bring our business up to the standard and dignity, which it deserves. It is no longer a hit and miss affair but a business where real engineering skill and ability is required.

"We believe that if changes are made along the lines indicated that there will be

(a) Less duplication of work in the contractors' offices.
(b) Elimination of disputes and controversies.
(c) The owners will be safeguarded and protected.
(d) Public confidence in our dependability and integrity will be increased.

"All of the above aims are most desirable and we earnestly desire your cooperation in bringing them about."

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Western New York Chapter Getting Ready for Society's Summer Meeting

Plans were launched by President C. W. Farrar at the March meeting of the Western New York Chapter for entertaining the American Society of Heating and Ventilating Engineers at its forthcoming summer meeting in Buffalo and Detroit, June 7-10. At the opening of the meeting, which was held March 7 in the Engineering Societies' clubrooms, in the Hotel Iroquois, President Farrar announced that the dates of the summer meeting had been definitely fixed. The opening sessions will be held in Buffalo June 7-8 and the concluding sessions in Detroit, June 9-10. He then announced the appointment of the entertainment committee for the summer meeting, consisting of William G. Fraser, chairman, and Warren Hillis, Edgar Wendt, F. B. Howell, C. P. Wadley, all of Buffalo; Bert C. Davis, of Elmira; and Fred K. Taylor and Fred Weider of Rochester.

The first speaker of the evening was R. M. Chatterton, treasurer and general manager of the Smith Gas Engineering Company, of Dayton, O. His talk was on the manufacture and application of clean producer-gas from hard and soft coal, and lignite, peat, coke, and charcoal and its application to the heating of buildings. He gave some interesting data on the relative cost of heating by gas and by coal. He also went extensively into the problems of generation and the design of apparatus.

C. J. Swan then addressed the meeting on the latest designs of valves for use in connection with low-pressure steam heating systems. He explained the design and action of the metal bellows, drawing extensively on his experiences in connection with research, manufacture and sale of heating specialties. Both speakers illustrated their talks with lantern slides.

Forty members and guests attended the meeting which was preceded by a dinner. One of the out-of-town guests was Frank G. Phegley, former president of the Ohio Chapter, who spoke briefly on the coming summer meeting of the society and pledged the hearty support of the Ohio Chapter in furthering the plans.

New Officers of Philadelphia Chapter.

New officers of the Philadelphia Chapter, elected at its March meeting, held March 10, at the Engineers' Club, are as follows:

President, Frederick D. Mensing; vice-president, Thornton Lewis; secretary, H. B. Hedges; treasurer, H. A. Terrell. Board of governors: H. P. Gant, R. B. Beahm and R. E. Jones.

Among those who addressed the chapter, at this meeting, were C. V. Haynes, of the society's membership committee; Thornton Lewis, who spoke for the legislative committee on the subject of the licensing of engineers; Homer Addams and Frank K. Chew. A. C. Edgar announced that the April meeting would be devoted to "Smokeless Combustion of Bituminous Coal."

Illinois Chapter Discusses Fuel-Oil.

"The Use of Fuel-Oil for Small Heating Plants" was a subject that drew a large attendance at the March meeting of the Illinois Chapter. The meeting followed a dinner at the Chicago Engineers' Club, March 13.

After disposing of the routine business, including the election to membership of Charles A. Crannell, President Cutler introduced Charles D. Allan as the chairman for the evening. Mr. Allan presented a carefully-prepared paper giving many facts regarding crude oil and the processes necessary for its use as a fuel.

The meeting then resolved itself into a symposium on the various makes of fuel-oil burners on the market. William T. Dean, of the Combustion Company, of Chicago, showed a number of slides of the Ryerson Crane oil burner made by his company, together with views of typical installations. Mr. Eaton of the Winslow Boiler & Engine Company, predicted that eventually oil will displace coal as a fuel and presented slides of the Kleen Heet oil burners. A. B. Frenier, of the Amalgamated Machinery Corporation, declared that at the present time the need is for the development of boilers that will absorb the heat generated by the oil-burners. He showed numerous slides of the No-Kol oil burner.

Other speakers were John A. Castino, of the Master Oil Burner Company, Charles J. Goodhart, of the Rotary Oil Burner Corporation and Mr. Ward, of the Oil Burning Equipment Company.

St. Louis Chapter Hears Address on Heating of Skyscrapers.

A talk on "The Heating of Skyscrapers," by William H. Driscoll, chief engineer of the Thompson-Starrett Company, New York, at the March meeting of the St. Louis Chapter, provided one of the most interesting evenings in the history of the chapter. Mr. Driscoll's talk was unique in that he had no set paper, due to the fact that his subject was so extensive and that in different localities the interest is centered on different phases of the work. Instead he undertook to proceed along lines indicated by the members who were invited to ask questions, criticise any statements he made or offer suggestions that were pertinent to the subject.

There was not a dry moment during the talk, the audience hugely enjoying the impromptu character of the remarks together with the blackboard sketches with which the speaker illustrated his points. In addition, a number of stereopticon slides were shown exhibiting several types of tall buildings, such as the Union Trust Building in Cincinnati, the McAlpin Hotel, Woolworth Building, Municipal Building and Equitable Life Building in New York.

A general description of the installations in these buildings was followed by a detailed description of the Equitable Life Building, in New York, with its 40 acres of rentable floor space. One of the most interesting features of the Municipal Building, said Mr. Driscoll, is its smoke stack. The building covers practically two blocks and there is a subway station in the basement so that the boiler room had to be located at one end of the building. The smoke is carried over the street to the other end of the building in a horizontal duct for nearly two blocks to the stack.

The general scheme of heating the Equitable Building he said, is by exhaust steam, collected from the engines and pumps into a receiver or muffler chamber, whence it is carried into a 30-in. riser to the supply main on the 36th floor, about 500 ft. above the ground. This part of the riser weighs about 65,000 lbs. and is supported on a special foundation and bled through a 4-in. trap to the return receiver.

The tee for the branch is supported on a special platform built in the steel of the building and just below the tee is a special slip expansion joint bolted to the platform. The chief point of interest in this joint, which takes care of all the expansion of the 500 ft. is the traverse which is 9 in. The actual expansion that occurred when steam was turned on was about 7¼ in., but as this pipe is never allowed to cool, the working traverse is much less. There is a back-pressure valve on top of the branch which can be opened from the engine room when necessary.

The riser is guided at intervals by a device causing four rollers to bear on the pipe. Mr. Driscoll was of the opinion that if the last length or two were guided accurately, the joint would not bind, which is the object of the guides.

Plans of the piping space on the 26th floor were shown. All floors below are supplied by down-feed and the floors above by up-feed. The returns from the upper floors are collected at this point and conveyed to the receiver in one pipe.

Various methods of providing for expansion were shown and the importance of accuracy in this connection emphasized, as all risers and branches must be concealed. A small mistake in the allowance for expansion might mean the breakage of a fitting and when it is remembered that all these are covered in concrete, it will be realized that this was one of the most important considerations in the whole design.

IMPORTANCE OF HEATING UNEXPOSED BATHROOMS.

Among the interesting points brought up in connection with hotel heating was the fact that when unexposed bathrooms are not heated the guests often leave the windows open at night and then complain of cool bedrooms in the morning. On the other hand where such bathrooms are heated, they are often used as dressing rooms and obviate such complaints.

Mr. Driscoll told of an instance where a certain specification called for a two-pipe job, with steam radiators. Later it was decided to use a top supply connection. The contractor suggested water radiation, but the difference in cost was too great, so the radiator people were called in and agreed to cast steam radiators with a top opening. This is now working and giving satisfaction.

Much interest was shown in the method presented by Mr. Driscoll for figuring radiation for a skyscraper, which brought a glowing tribute from him to the work the society's Research Laboratory is doing in developing standard coefficients that will be universally recognized as correct.

St. Louis Chapter's February Meeting

At the February meeting of the St. Louis Chapter, E. S. Hallett presented a paper on "The Determining Factors Used in Heating and Ventilation." He laid particular stress on the point that the real cost of a heating, ventilating or power plant is the first cost, plus the operating and maintenance costs for the life of the plant. It is therefore the work and duty of the engineer to consider all the factors involved, including location, transportation facilities, elasticity required and all of the various apparatus of whatever make. He should then draw graphs or charts of the various systems, with the costs that could be considered pertinent, and by comparison and elimination select the combination that is particularly suited to the conditions of the proposition in question. His point was illustrated in the problem recently worked out by Samuel R. Lewis, of Chicago, for heating a group of university buildings.

It was announced that subsequent meetings of the chapter would be devoted to such subjects as "Combustion," with J. F. McIntire of the United States Radiator Corporation as the speaker; and the manufacture of pipe, with a representative of the Reading Iron Company as the speaker. It is planned to make the concluding meeting of the season an outing at the new Riverview Country Club, where the attractions will be golf, swimming and dancing.

The appointment was also announced of a Research Fund Committee, consisting of E. P. Bradley, chairman; E. A. Jones and C. W. Adams.

Annual Meeting of British Heating Engineers.

A broader outlook on the part of the heating and ventilating profession was advocated by A. H. Barker, the newly-elected president of the Institution of Heating and Ventilating Engineers, in his inaugural address at the annual meeting of the institution, in London, February 7. There was a tendency, he said, to be too narrow, as though the only things of importance were boilers, radiators, pipes and fans. It was necessary to consider the art, he continued, more than heretofore in relation to architecture, hygiene, physiology, general science and even law.

Mr. Barker discussed the advances in both gas and electric heating and maintained that heating engineers must make up their minds that much more would be heard of gas than formerly in relation to heating. As to electrical heating, he pointed out that while it was too expensive to warm a room with electric radiators, as is done with hot water radiators, it is possible to be quite comfortable in a cold room with an electric radiator under one's feet. Colonel Crompton, he said, had stated recently that local electrical heating of that character could be economically effected, and Doctor Leonard Hill had some original ideas about the physiological aspects of electrical warming. It is quite possible, declared Mr. Barker, that some researches, half technical and half physiological, might determine the conditions under which heating by electricity might be enormously increased.

In reporting for the institution's Research Committee, E. Herring dealt more particularly with the investigations, made by M. Kinoshita at the University College, London, of the emissivity of radiators. One important result had been obtained, he said, in the establishment of the fact that the transmission of heat is proportional to the 1.3 power of the temperature difference. This means, he said, that we now have a constant for a particular radiator. The figure given was confirmed by tests of two radiators of extreme types, one being a single-column 38 in. high, and the other a 13-in. window-seat type. A third and subsequent test, made with one of the new Classic types of radiators, afforded further proof that the constant was reliable.

Other experiments, made with high and low radiators with top-bottom and bottom-bottom connections, had shown that whether on the same side or at opposite sides, the top-bottom connection gave from 10% to 11% higher transmission than bottom-bottom connections.

It was announced that an improved method of testing temperature drops in water heating systems had been devised and would soon be put into operation. The particular point that it is desired to determine is where the circulation is either very fast or very slow.

For the District Heating Committee, F. Biggin told of the conferences that have been held with the Institution of Electrical Engineers to consider the utilization of waste heat from electric generating stations. Further conferences will be held to develop some practical measures in this direction.

It was decided to hold the summer meeting of the institution in Oxford, July 3, the autumn meeting October 10, and the next annual meeting February 6, 1923. An extra provincial meeting will be held in Birmingham, December 5.

Engineers Too Timid and Too Modest

While the engineer has unquestionably done more for civilization than any other professional man and if what has been accomplished by him were to be wiped from the earth, humanity would be right back in the Dark Ages, yet he receives less appreciation and recognition from the public than either the doctor or the lawyer. This statement, which was made by George R. Fansett, one of the engineers of the Bureau of Mines and attached to the staff of the University of Arizona, was supplemented by the declaration that this is the fault of no one but the engineer himself, his inherent timidity and modesty keeping him from seeking the publicity to which his accomplishments entitle him.

As reported in the *Southwest Contractor and Builder*, Mr. Fansett went on to say that the engineer in refusing to enter public life in an endeavor to correct some of the glaring faults of administration, when such exist, is a mental coward. The engineer has the one most important asset for entering into public life—he has the confidence of the public that he is honest. Mr. Fansett attributes the failure of the engineering profession to reach its highest plane of advancement to the absolute unresponsiveness of the engineer as a citizen, and his aloofness in all matters outside of his own profession.

Mr. Fansett stated there are three prob-

lems to solve with regard to the engineer. First, to solve the engineer, himself—eliminate cheapness, cut-throat tactics, penuriousness. Second, to educate the public to appreciate what the engineer has accomplished in material lines, to realize his value to humanity. Third, a thorough revision of the curriculum of engineering colleges. He gave it as his opinion that among the professors who are in charge of training prospective engineers in many of our colleges there is much dead timber which must be cut out, if the student is to receive full value for the time he is spending in obtaining an engineering education.

WHERE DO WE GO FROM HERE?

Price and other cycles were presented in an interesting chart form in an address by Leonard P. Ayres, vice-president of the Cleveland Trust Company, before the Associated General Contractors, in Cleveland, recently. The first chart he presented, showing wholesale prices for the past 110 years, brought out very clearly the three great economic cycles in the history of the United States.

While these things were happening to general costs, Mr. Ayres showed (Fig. 2) the cost of general building construction during the past eight years made from a weighted measurement of the shifting prices of the fifteen most important building commodities and of a weighted measurement of the shifts in the cost of building labor.

FIGURE 1.
WHOLESALE PRICES

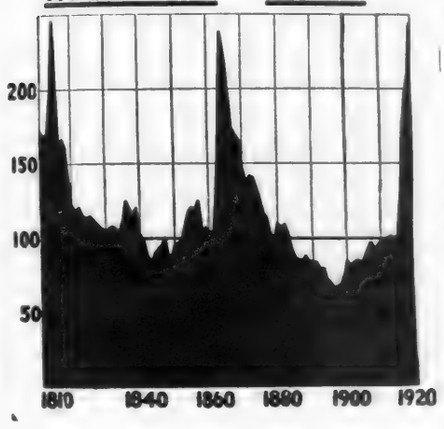


Fig. 3 was presented to show how much recovery in construction is occurring. Each one of the black upright columns represents in millions of dollars the amount of building permits in the 20 leading American cities each year over the past 21 years. The last columns, partly solid and partly in outline, represent in their entire height the total amount of money spent. That building, however, was very expensive building and the black portions show, on the same basis as for the earlier years, how much construction was actually done. The slanting straight line represents (over the first part of the period) the general trend of construction that was increasing as these cities grew in population.

FIGURE 2.
COST OF CONSTRUCTION

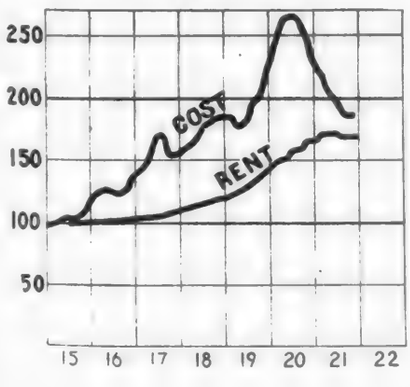
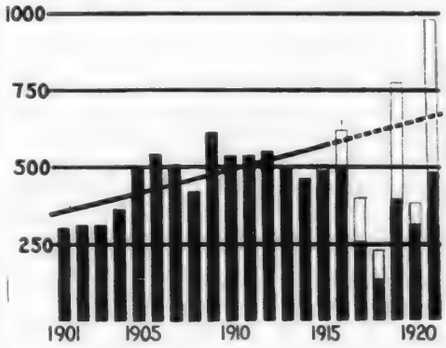
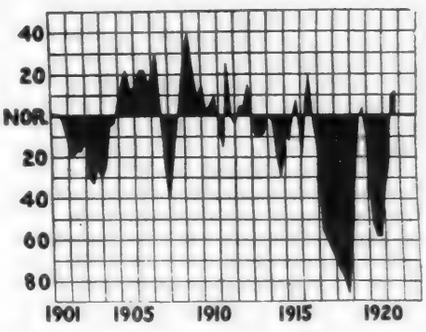


FIGURE 3.
BUILDING IN 20 CITIES



After finding that the curve checked with computations from Bradstreet's figures covering some 120 cities, the speaker took the straight slanting line and made it into a horizontal line (Fig. 4) and put below the deficiencies and above the surpluses. "20" in 1902, means 20% below normal in that year, and so on.

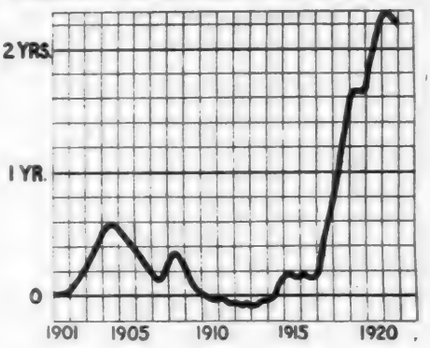
FIGURE 4
BUILDING IN 20 CITIES



This, said Mr. Ayres, brought up the query, "How far behind the game are we?" and he showed, in Fig. 5, the accumulated results of the previous chart.

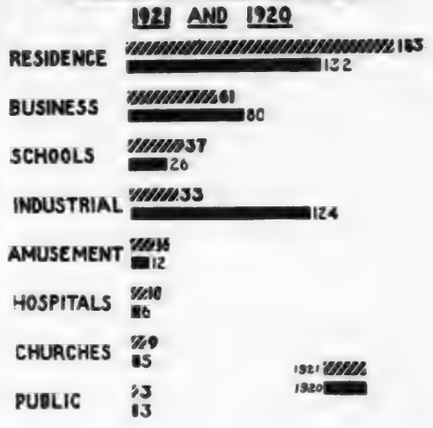
In Fig. 6 each pair of bars is a comparison of the amount of construction done in 1921 with that done in 1920, for one particular class of buildings. The upper bar of each pair corresponds to 1921, the lower to 1920.

FIGURE 5
BUILDING SHORTAGE IN 20 CITIES



Summing up the results of his analysis, Mr. Ayres stated that the construction industry is entering a period of great accumulated shortage at a time when interest rates have fallen far, far below what they were and when the difficulties and problems of financing are rapidly disappearing. Thus he thought, the problems of financing are largely ended because money is easy and seeking investment, prices have come down to a relative stability, and a shortage exists.

FIGURE 6.
MILLIONS OF FEET OF BUILDING 1921 AND 1920



"These," he concluded, "are the three factors which are necessary and present for increased activity in the building industry. We are entering this era at a time when your industry, like every other industry, is going to find that its problem is one of more efficient management and of delivering to the buyer a large value for the dollar that he has given."

New Interest in the Smoke-Abatement Movement

Persistent appeals are reported by the Bureau of Mines for assistance in combating the smoke nuisance. Municipal authorities or organizations, it is stated, in New Orleans, Kansas City, Salt Lake City, Akron and Springfield, O., and many other large cities, have recently asked the bureau for advice in fighting the smoke evil.

The prevention of objectionable smoke in the manufacturing and business centers of large cities is a problem that can not be easily solved, the Bureau of Mines

declares. At present no city in which a considerable quantity of bituminous coal is burned is free from smoke. The cities of the East have avoided this problem by a general use of the smaller sizes of anthracite coal. For this reason it is not surprising that the greatest improvement in the methods of burning bituminous coal has been made in the Central and Western States.

A report summarizing the smoke prevention investigations of the Bureau of Mines has just been issued.

New England Heating Men Give Dinner in Honor of William F. Stearns.

William F. Stearns, who has just retired as New England branch manager of the American Radiator Company after a service of seventeen years and a total service of a quarter of a century with the company, was the guest of honor at a notable dinner tendered him by more than 100 heating, ventilating and plumbing contractors and jobbers of New England, at Young's Hotel, Boston, on the evening of March 11. Mr. Stearns had been asked to meet a few friends at the hotel and he was wholly unprepared for the scene that awaited him as he was escorted into the dining room by Robert E. Sargent, of the Standard Sanitary Mfg. Company.

The diners greeted Mr. Stearns with cheers and songs, fairly drowning the strains of the orchestra which could be heard only at intervals. Frank S. Cleghorn acted as toastmaster and opened the post-prandial festivities by presenting Mr. Stearns, on behalf of the diners present, with a handsomely-mounted traveling bag, together with a leather-bound souvenir menu and program with the signatures of those present. Mrs. Stearns was sent a bouquet of carnations.

Mr. Stearns made a brave attempt at a response but it was plain to be seen that his training as a sales manager had hardly prepared him for this occasion. As he concluded someone proposed that the gathering buy for Mr. Stearns "the Algonquin Club house for Boston home and the Thomas Plant Golf course and clubhouse for a country estate." The sentiment was enthusiastically applauded and the resolution adopted to three times three.

Toasts were next in order and these were responded to by William P. F. Ayer, Walworth Mfg. Co.; Frank W. Howard, Ingalls & Kendricken, Boston; Ira P. Smith, Worcester; W. T. Isaac, Gurney Heater Mfg. Co., Boston; William R. Park, Jr., Taunton; John R. Slattery, Crane Co., Boston; Daniel S. Carroll, Lowell, ex-president of the Massachusetts Master Plumbers' Association; Fred H. Round, Portland, Me.; J. D. Stiles, Jenkins Bros., Boston; D. J. Daly, Springfield; E. Q. Cole, Holyoke; Ralph S. Franklin, A. B. Franklin Co., Boston: Frank A. Merrill, Merrill Co., Boston; Wilbur Thompson, Newton, ex-president of the Massachusetts Master Plumbers' Association; G. Frank Uhler, A. M. Byers Co., Boston; and David Calhoun, Portland, Me.

The committee in charge of the event consisted of J. E. Slattery, Robert E. Sargent, F. S. Cleghorn, Ralph S. Franklin, John P. Gallivan and C. W. Sisson.

Mr. Stearns, who is succeeded as New England manager of the American Radiator Company by William F. Gilling, Jr., is at present sojourning in the South and has not as yet announced his future plans.

Amount of Heat Loss in Condensate.

There appeared in THE HEATING AND VENTILATING MAGAZINE for March a brief paper under the title of "The Importance of Proper Condensation Control" in which there appears the bald and bold statement that "for every degree Fahrenheit above the minimum (temperature) requirement there is approximately 100 heat units (B. T. U.?) loss per pound of condensate."

The first spontaneous suggestion is that the writing computor is the victim of a slide rule which makes no account of a matter so minute as that of a decimal point. Assuredly the writer could not expect the reader to believe that a rise of 10° in the temperature of the condensate above 125° F. means 1000 B. T. U. loss per pound of steam passed through a heating system, a loss of more than 100%, if steam is made and supplied to radiators at 3 oz. pressure and condensed at normal atmospheric pressure. And yet what other rational interpretation can be given to his wording, or what more logical application to his meaning?

By the return of condensate from radiators having a sufficiently large condensing capacity above the rate of steam fed to them, the temperature of the return condensate may be made as low as 125°, and proportionately more heat may be yielded per pound of steam fed to the heating system. If steam at 5 oz. is supplied to radiators and condensed at 213° F., the heat yield is 962.7 B. T. U. per pound. If, before return to the boiler, that condensate is cooled to 125° F., the heat yield becomes 1050.7 B. T. U. per pound, a gain of 88 B. T. U., or 9.14%, or 1 B. T. U. per degree difference in the temperature of the condensate.

But, in the matter of fuel required to effect any given heating work, there is practically no gain because of that temperature drop, per se, in the condensate, and for the manifest reason that whatever of heat is yielded *by* the condensate to bring its temperature from 213° to 125°, must be yielded *to* that same water within the boiler to raise the temperature from 125° to the boiling point, 213° before that water can be converted into steam. In other words, all the heat yielded through radiators, heaters and piping must of necessity be made good by the boiler fire; all that is given out must be given back.

The only gain in the entire circuit of a heating system made available through the lowering of the temperature of the condensate is in the resulting lowering of the temperature of the "heating surface" of the boiler, and the consequent larger abstraction of heat from the combustion gases from the fire before their escape to the chimney.

If, in the above instance, the condensate is returned to the boiler at 213° in one case, and at 125° in the other, the corresponding mean temperatures of the boiler's "heating surface" would be 213° in one case and 169° in the other. If the mean temperature of the combustion gases is 900°, the percentage of gain by the lowered temperature of the condensate would be $\left(\frac{900-169}{900-263} - 1. = 0.107\right)$ 10.7%

Such saving may often be of sufficient magnitude to warrant a cooling of condensate to the lowest practicable point before return to the boiler.

THERMOS.

Boston, Mass.

Development of the Herbert Boilers.

The fact that the Herbert Boiler Company, of Chicago, manufactures both magazine water-tube smokeless boilers and also detachable firebox boilers has led to inquiries as to the conditions for which each type is best suited. In discussing the subject, M. E. Herbert, president of the Herbert Boiler Company, states:

"The magazine boiler that burns soft coal, which has recently been patented by me in the United States, Canada, England, France and Germany, is designed to carry steam in dwelling houses, apartments or bungalows from 20 to 24 hours, with mine-run soft coal and to consume the black smoke. The writer has been working on this matter for years because it is a hard matter to carry a large body of soft coal without producing gas. The magazine in the smallest of these boilers holds about 230 lbs. of soft coal. It is a direct-fired boiler and is automatically regulated, consuming the coal as it is required to produce the necessary heat for the building in which it is installed. Precautions are taken in the design to prevent its throwing off gas in the basement or in any other part of the building.

"The gas is consumed by the flames from the coal as it is generated. This may be seen by noting the position of the magazine. It will also be noticed that pains have been taken to arrange the magazine conveniently for the feeding of coal. For that reason the magazine opening is placed directly in front of the boiler and not too high to reach with a shovel.

"Now regarding the down-draft boilers. These are designed solely to consume the smoke produced from soft coal. When properly constructed, with the necessary draft, they are capable of consuming from 90% to 95% of the black smoke from the chimney. As is well-known the down-draft proposition has been on the market for the past 25 or 30 years, being first introduced by Hawley, who was at the time a master mechanic for one of the St. Louis railroads. There have been several improvements made on the furnace by myself and others, but if it is not properly installed, with the necessary appliances, it is a flat failure. The down-draft proposition must have a high chimney and a good draft and should not be installed in any

place where the gases cannot expand after they become heated to the proper temperature. Where the down-draft furnace is properly installed, it is a very good hand fired proposition to abate smoke."

New Books.

MANUAL FOR ENGINEERS, 25th edition, has just been issued by the University of Tennessee. This handy booklet of engineering data has long ago established itself as one of the most useful publications of its kind. The particular merit of the book is the selection of about 50 tables that the busy engineer and business wishes to have handy. The fact that the book is gotten out in vest pocket size makes it easy to always keep it in one's pocket. Published by the University of Tennessee, Knoxville, Tenn. Size 3 x 5¾ in. Pp. 229. Price 75 cents.

PLUMBERS' HANDBOOK, by Samuel E. Dibble, head of the heating, ventilating and sanitation department at the Carnegie Institute of Technology, Pittsburgh, Pa., which has just been published, is a notable handbook of reference data for both heating and plumbing men. In addition to his own data, Mr. Dibble has secured contributions from a number of men, including Professor Robert B. Leighou, of Carnegie Institute of Technology, who has a section on "Metallurgy and Chemistry;" F. N. Speller, metallurgical engineer, of Pittsburgh, who discusses "Pipe Standards and Pipe Dies;" and Alphonse A. Adler, consulting engineer, New York, who writes on "Heating." These contributions make the book of considerable interest to the heating engineers and contractors. The book is well-bound in flexible leather and contains some 316 illustrations. Size 4½ x 7 in. Pp. 629. Price $4.00. Published by McGraw-Hill Book Co., New York, or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

HEATING AND VENTILATION, second edition, by the late John R. Allen and J. H. Walker, has been published by the McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York. The book is a little larger than the first edition, the additional matter dealing with radiator data, including curves for the effect of varying widths and varying lengths. There is also newly-added matter on the effect of enclosing radiators and on radiation and convection from various types of radiators. The Synthetic Air Chart developed by Dr. E. Vernon Hill and adopted by the American Society of Heating and Ventilating Engineers, together with the method of testing air conditions through the use of the chart, are presented in the new edition. Unit ventilation systems are also given a place for the first time. Much of the other matter is brought up to date and rearranged. Size 6 x 9 in. Pp. 332. Price $3.50. May be had from the publishers or through the book department of THE HEATING AND VENTILATING MAGAZINE.

AUDEL'S ENGINEERS' AND MECHANICS' GUIDE No. 7 has been published as one of a series of books on engineering subjects for mechanics, engineers and electricians. There are eight volumes in all. Vol. 7 contains some 550 pages and 1071 illustrations covering heating and ventilation and, in addition, pipe, fittings and pipe fittings, refrigeration, cooling towers, condensers, distilling apparatus, elevators, cranes and hoisting machinery, and ropes and cables. The text-matter is written in the form of questions and answers and will be found to contain an unusual amount of information in compact form. Size 4¾ in. x 6½ in. Pp. 550. Price, $1.50. Published by Theo. Audel & Co., 72 Fifth Avenue, New York, or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

New Publications.

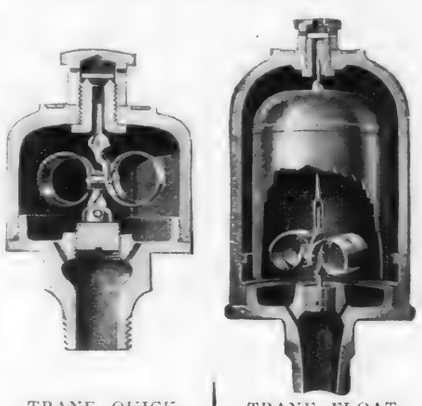
THE SCHOOL OF GREATER OPPORTUNITIES, referring to the course in heating and ventilating engineering conducted by the Cleveland Engineering Institute, Cleveland, O., is the title of a new publication brought out in connection with the recent reorganization of the institute. The course is now divided into 52 sections, instead of 60, and it is stated that the average student should be able to finish it within one year. In addition to the 52 sections or lessons, there is a sub-course in mechanical drawing designed especially for students in connection with the course. The tuition for the complete course is $130.00, payment being made in monthly installments. A number of manufacturers' names are published in the circular whose representatives are enrolled with the institute.

THE STORY OF THE BATH, although dealing with what is generally considered a plumbing subject, is so well told in a booklet issued by *Domestic Engineering*, Chicago, Ill., that it will prove entertaining reading to a much wider field. The attractiveness of the booklet is enhanced materially by a series of border illustrations which deal with the history of the bath from every conceivable angle. Finally, the artistic touches displayed in the design and typography render "The Story of the Bath" a publication which will adorn the library, as well as the office desk. The story is told by Edwin L. Barker and illustrated by Albert W. Barker. Size 6 x 8¼ in. Pp. 32. Price 25 cents.

WORK OF THE AMERICAN ENGINEERING STANDARDS COMMITTEE (1921), published by the American Engineering Standards Committee, is the title of a recent report devoted to important developments that have taken place in the movement to nationalize engineering and industrial standards. The artivities of the American Engineering Standards Committee, it is stated, have developed to such an extent that work is now under way on 79 distinct projects which have reached an official status. In its work 160 bodies of national importance are coöperating, these having designated more than 500 individuals as official representatives to serve on sectional committees working under the auspices of the American Engineering Standards Committee. Among the coöperating bodies is the American Society of Heating and Ventilating Enginers, the project for which it is acting as sponsor being a safety code for ventilation. The publication contains the constitution of the committee, as well as its revised rules of procedure.

Trade Literature

TRANE THERMAL VENTS, devoted to Trane quick vents and Trane float-vent valves, is the title of a new bulletin (No. 12) recently issued by the Trane Co., La Crosse, Wis. The Trane vent valves, it is stated, are the product of years of experience with the various venting needs of vapor, vacuum and pressure heating systems. They are for use in venting mains, risers, pipe coils, indirect radiators, Vento heaters, blast coils and similar units. Both the quick-vent and float-vent types are designed with full ¼-in. venting ports to insure quick and easy escape of air



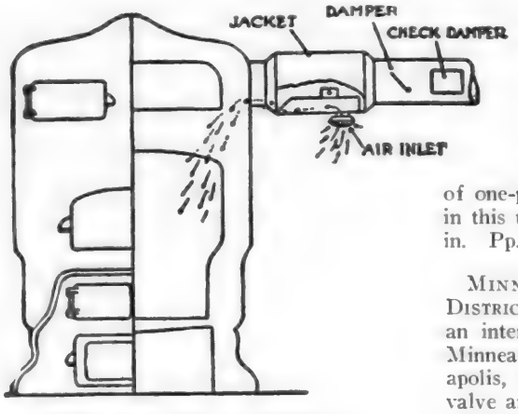
TRANE QUICK-VENT VALVE. | TRANE FLOAT-VENT VALVE.

from the system. The thermostatic element in both patterns is the well-known all-metal member used in Trane Thermetal traps. In describing the uses of the two types, the quick-vent valve is especially adaptable for large venting requirements where dry steam is assured. The float-vent type is used for venting requirements close to the water-line or wherever there is a possibility of water reaching the valve. The float construction is intended to prevent the escape of surging water from the valve and at the same time to provide a large float of sufficient buoyancy to insure its positive operation under relatively high pressures. Its capacity is 1500 sq. ft. of radiation. Size 6 x 9 in. Pp. 4.

HOT WATER FOR TEXTILE PLANTS is discussed in a folder received from the Patterson-Kelley Co., 26 Cortlandt St., New York. Attention is called to the way dyeing is done in some plants where the vats or machines are filled with cold water and live steam is blown in or passes through a pipe coil in the vat. The boilers, which may have been designed only for power purposes, "stall" and the fireman heaps on coal trying to keep up steam. The water slowly creeps to the boiling temperature, the dye mixes slowly, streaks, spots, assimilates improperly and the process consumes from 70 to 80 min. Live steam is made at the direct expense of fuel, thus increasing the fuel cost, as well as labor.

It is stated that with the Patterson system it is possible to reduce dyeing cost at least 50%. With this system the vats are filled with hot water at the desired temperature directly from the Patterson heater and the boiling temperature is reached in from 10 to 20 min. When this happens, less dye is needed, it mixes better and it is possible to double the vats' output. Waste steam from engines, pumps and steam, operated machines is used as the heating medium. 200 installations are listed in the folder.

BURNALL, a device for admitting air for combustion purposes in the flues of boilers and furnaces, is brought to the attention of the trade in a circular issued by the manufacturer, Royal Burnall Fuel Saver, Inc., 140 Nassau St., New York. As will be seen from the illustration, it is a metal device, without movable parts, bolted in the smoke pipe of the heater. It is made in one piece and, it is stated, works equally well with hard or soft coal, coke or wood It operates to draw outside air into the



INSTALLATION OF BURNALL IN BOILER SMOKE PIPE.

smokepipe, superheat it and cause it to mix with the combustion gases. This mixture it is claimed is driven and pulled back into the fire where it is consumed. The company issues a 25% fuel-saving guarantee.

DOMIC WATER HEATER, designed to use the boiling water (or live steam or vapor) from heating boilers for domestic supply, is a new addition to this line of appliances which has been put out by the Central Radiator Co., New York, and described in recently-issued circular matter. It is featured as being easy to connect to any steam or vapor heating boiler, old or new. The installation is made entirely on the outside of the boiler and no connections enter the firebox. The appliance consists of two cast-iron chambers assembled one inside of the other. These castings are machined on top at slightly different tapers to form a dependable joint connection to meet every expansion requirement. There is no packing or gaskets. In operation the water from the heating boiler (below the water-line) circulates through the outer chamber at boiling temperature, heating the domestic water, which passes through the inner chamber. The appliance may also be used to heat water by live steam or vapor above the water-line. The Domic water heater is furnished in three sizes with capacities of 30, 45 and 60 gals., respectively.

MATHIS MULTIBLADE BLOWERS, with "Ferris type" wheels, are illustrated and described in a catalogue received from A. Mathis & Son, Inc., Chicago, Ill. In these wheels the hubs are one-piece castings machined all over, with receiving slots for the spokes. The spokes are V-shaped, formed of mild round steel, threaded each end for adjustment nuts. The center annular ring consists of a heavy, one-piece ring to which the floats are riveted. The middle ring receives the power impulse. Standard construction embodies 48 curved floats pitched in the direction of rotation. The floats are formed and flanged and are riveted to center and outer rings, thus equallizing stresses at these points. The tendency of floats to bow at center, as in ordinary construction of one-piece floats, it is stated, is avoided in this unique construction. Size 8½ x 11 in. Pp. 8.

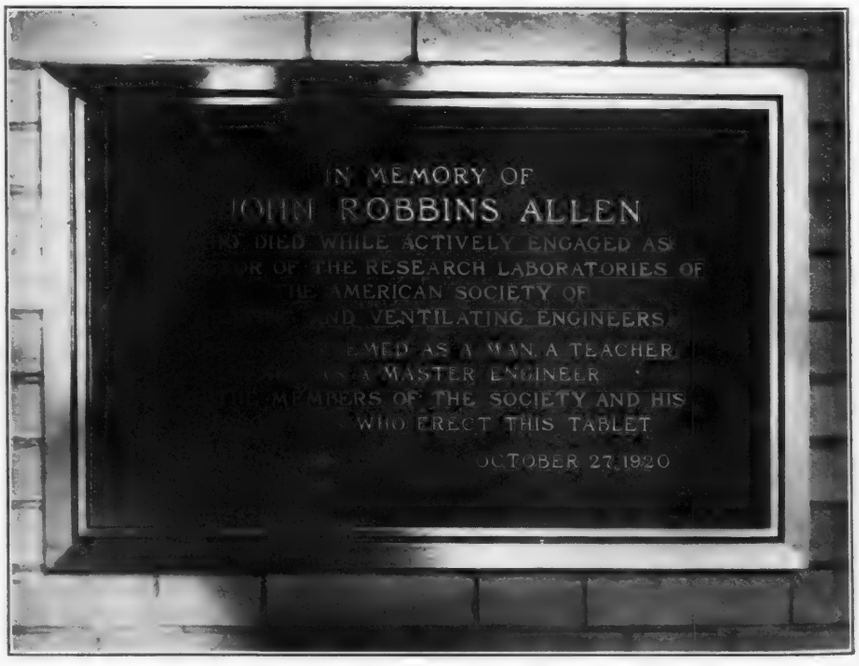
MINNEAPOLIS HEAT REGULATORS FOR DISTRICT STEAM SYSTEMS are featured in an interesting circular received from the Minneapolis Heat Regulator Co., Minneapolis, Minn. A typical installation of valve and motor in the basement is shown and it is pointed out that nothing appears upstairs except the small thermostat. Comparative thermographic records are included showing the different conditions prevailing in a residence before and after the installation of Minneapolis heat regulators, the claim being made that the savings amount to from 25% to 30 of the steam consumption.

WHEEL OF MATHIS MULTIBLADE BLOWER.

The Weather in Chicago for January, 1922.

In the weather data table published in THE HEATING AND VENTILATING MAGAZINE for March, the mean temperature for Chicago for January, 1922, was given as 32.5° F. This should have been 24.8°. The normal mean temperature for the month, which was given as 31.5°, should have been 25.1°. The lowest temperature for the month was —1° F. The chart itself, on which were plotted the Chicago weather records, was correct as published.

The publication of the March weather records will conclude the 1921-1922 series.


IN MEMORY OF
JOHN ROBBINS ALLEN
WHO DIED WHILE ACTIVELY ENGAGED AS
OF THE RESEARCH LABORATORIES OF
THE AMERICAN SOCIETY OF
AND VENTILATING ENGINEERS
MED AS A MAN A TEACHER
A MASTER ENGINEER
MEMBERS OF THE SOCIETY AND HIS
WHO ERECT THIS TABLET
OCTOBER 27 1920

JOHN R. ALLEN MEMORIAL TABLET IN PLACE IN BUREAU OF MINES EXPERIMENT STATION, PITTSBURGH, PA.

From a painting by ADOLPH TREIDLER. © ARCO 1922.
Architect: AYMAR EMBURY, 2nd

An amazing saving in fuel

A HUNDRED AND THIRTY TONS of coal were used to heat this beautiful home of Mr. Louis H. Porter, Stamford, Conn., in the winter of 1916-17.

The following summer Mr. Porter had the old-fashioned, wasteful heating equipment taken out of his cellar, and two IDEAL TYPE A HEAT MACHINES installed.

In the winter of 1917-18, a hard winter, 76 tons were burned.

In the winter of 1918-19, a mild winter, 58 tons were burned.

There are many, many home owners who are paying a tremendous price for the extravagance of old-fashioned heat. We claim for the IDEAL TYPE A HEAT MACHINE an average fuel saving of one-third; Mr. Porter, and many other owners, have found that the claim is much too modest.

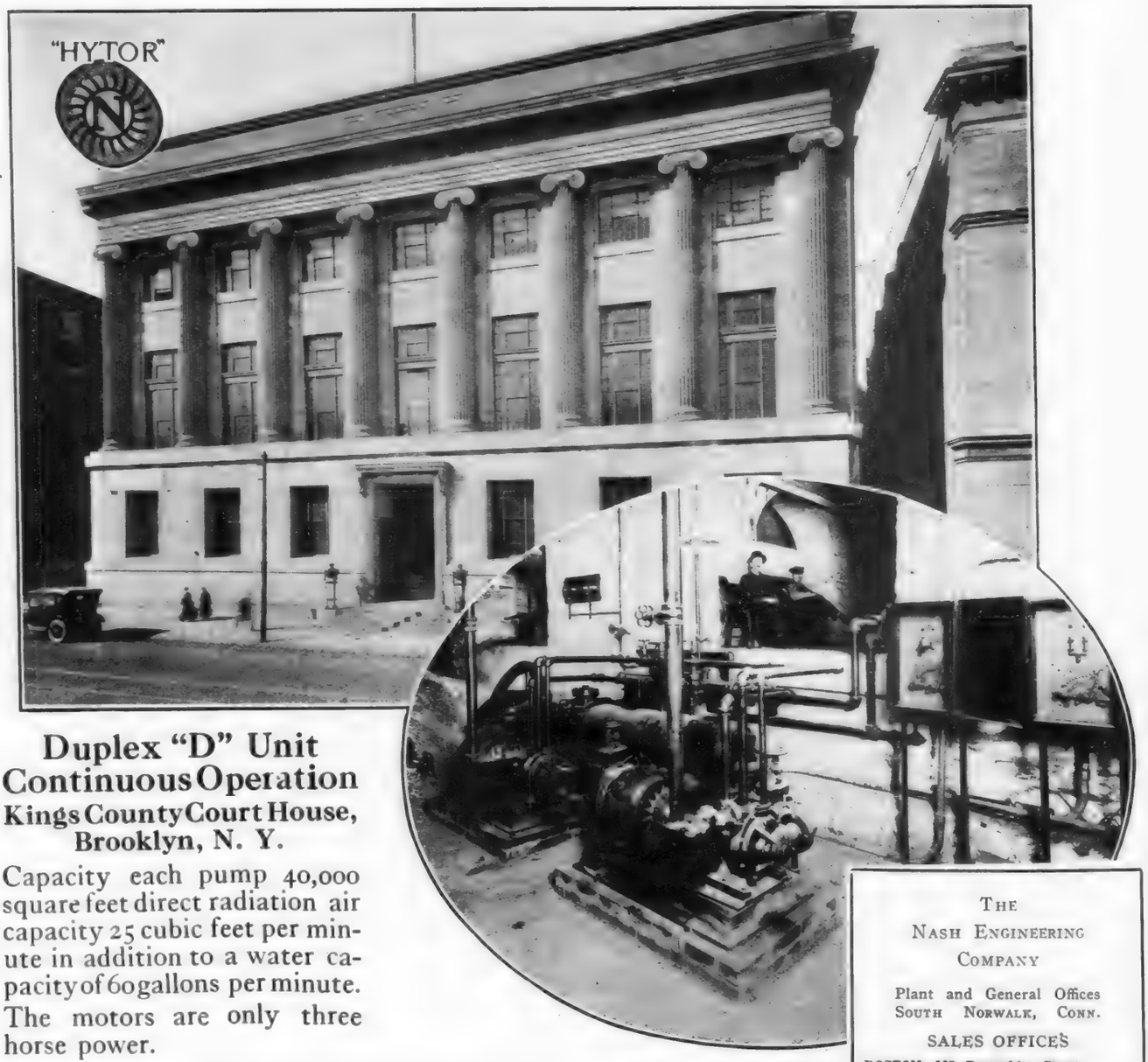
To Architects or Engineers who will have residences or small buildings under way this Spring: Your name on your letterhead, sent to either address below, will bring a finely illustrated book of the IDEAL TYPE A HEAT MACHINE showing heat test charts and details of construction.

AMERICAN RADIATOR COMPANY

IDEAL Boilers and AMERICAN Radiators for every heating need

104 West 42nd Street NEW YORK — Dept. 106 — 816 So. Michigan Ave. CHICAGO

EFFICIENT HEATING
demands the JENNINGS PUMP



Duplex "D" Unit
Continuous Operation
Kings County Court House,
Brooklyn, N. Y.

Capacity each pump 40,000 square feet direct radiation air capacity 25 cubic feet per minute in addition to a water capacity of 60 gallons per minute. The motors are only three horse power.

THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boiler pressure is against the water only. The air and vapor, approximately four-fifths of the volume handled, are delivered to atmosphere without back pressure. The saving in horse power is over fifty per cent. In other words, the cost of current to operate is cut in half.

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball bearings mounted outside of casing. Moving parts revolve without contact.

Quiet, reliable operation without annoyance because of shut downs, and minimum of expense for repairs, is assured if the Jennings Hytor Vacuum Heating Pump is installed on your Vacuum Heating System.

There are many other reasons why the Jennings is being installed on practically all of the big jobs. Bulletin No. 15 gives them in detail. Write for it.

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The NASH ENGINEERING COMPANY
SOUTH NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

Coming Events.

June 7-10, 1922.—Midsummer meeting of American Society of Heating and Ventilating Engineers, in Buffalo (June 7-8) and Detroit (June 9-10). Headquarters in Buffalo at the Hotel Iroquois and in Detroit, at the Hotel Wolverine.

June 20-23, 1922.—Annual convention of the National District Heating Association at Cedar Point, O. Headquarters at the Breakers Hotel.

May 15, 1922.—Annual meeting of National Pipe and Supplies Association, in Pittsburgh, May 16-17. Headquarters at the Hotel William Penn.

Miscellaneous Notes.

Fort Wayne, Ind.—First steps in carrying out the 1922 school building program were taken March 13 when the school board approved plans for the $70,000 improvement at the Hoagland School and the new heating systems at the Clay and Miner Schools. The architect of the Hoagland addition is Wayne Bell.

Chicago, Ill.—Open shop in ten Chicago trades is announced as the outcome of the fight sponsored by the Citizen's Committee in connection with the Landis award. This action has been taken in spite of the fact that the Building Trades Council publicly announced that it would live up to the award, although the carpenters later made a statement that they would demand $1.10 an hour instead of $1.00, according to the award. It is maintained by the Citizens' Committee that the Building Trades Council was not acting in good faith, as two weeks previously it had voted to go against the award and threw out Thomas Kearney, who was trying to support the award. According to the present situation, any man in the ten trades involved, which includes carpenters, lathers, sheet metal workers, cement finishers, composition roofers, tile roofers, fixture hangers, plumbers, hoisting engineers and laborers, must get employment by registering at the offices of the Citizens' Committee. Contractors who go along with these conditions must not take back their old men on jobs, but must refer such men to the employment office of the Citizens' Committee. Any man who obtains work through the employment bureau must agree in a signed contract to (1) work with Landis award, (2) work peaceably wherever placed (meaning non-union with union men) and (3) not to strike.

Albert W. Smith, former dean of Sibley College of Mechanical Engineering, Cornell University, known to thousands of Cornell men as "Uncle Pete," has become associated with H. R. Kent & Co., Rutherford, N. J., consulting and designing engineers. This firm is at present engaged in the design and installation of a new heating plant for Cornell University.

Professor Edwin Allen Fessenden, since 1906 professor of mechanical engineering and head of the department of mechanical engineering in Pennsylvania State College, has been appointed to the same position in Rensselaer Polytechnic Institute in Troy, N. Y.

New York's 'Own-Your-Home" Exposition will go on April 22-30 at the 69th Regiment Armory. The Chicago "Own-Your-Home" Exposition was held in the Coliseum, March 25-April 2.

Chicago, Ill.—The proposed minimum heat ordinance which has been for some time before the Chicago city council, was defeated when it came to a final vote.

THE LINE OF REGISTERED AUTOVENT NO REGRETS

Every Day's Mail Brings a Volume of Requests

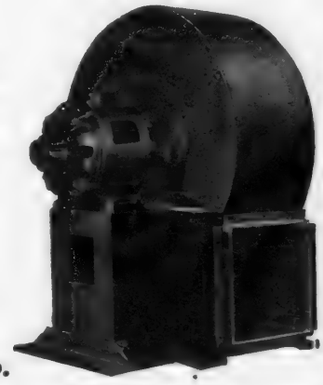
From prospective buyers in your territory—for prices and installation costs of AUTOVENT FANS and UNI-BLADE BLOWERS.

Our Sales Promotional Department is constantly developing and converting them into cash sales for our many dealers. Possibly we are not represented in your territory. If not, these highly profitable leads will be turned over to your organization for closing and the realization of a handsome margin of profit on—

The Sale of the Autovent Fan
On the Wire, Conduit, etc., used.
On the Autovent Louvre.
On the Autovent Fan Guard

Plus a substantial margin of profit on the sheet metal work and actual installation. One or two hours a day, systematically spent in closing these prospects will mean from $50.00 to $150.00 in profit to you.

Drop us a line today relative to our territorial sales rights regarding your territory, and Complete imformation will immediately be sent you.



Autovent Fan & Blower Co.
Formerly
Batterman-Truitt Company

Branch Offices in Principal Cities
730—38 W. Monroe St. Chicago.

PERFECTION SATISFACTION ABSOLUTELY GUARANTEED

It is claimed, however, by the friends of the measure that the bill is dead only temporarily and that it will be proposed in a new form later on. In the meantime the aldermen who voted against the measure, or who absented themselves at the time of the final roll-call, are the objects of a storm of criticism from tenants and their representatives, especially as a cold snap immediately followed the defeat of the proposed ordinance and caused a flood of complaints to pour in, charging inadequate heat.

Miles City, Mont.—Estimates received for constructing heating plants at the State College in Bozeman came to such a high figure, $420,000, that the State architects and engineers were obliged to cut down the plans and specifications so as to bring the cost to $350,000.

The Society of Heating and Plumbing Engineers is the title of a new organization of heating and plumbing contractors in Sioux City, Ia. The new body supersedes the previous Master Plumbers' Association.

Bloomington, Ind.—The members of the local school board have asked the city council for an appropriation of approximately $200,000 for building an addition to the local high school, together with a heating plant large enough to take care of both the High School and the Junior High School. The proposed new heating plant will cost $70,000, taking the place of the present one which cost $30,000. Architect Grindle is drawing the plans for the new addition.

Building Operations for February, 1922, were 73% greater in volume than in the corresponding month last year, according to the F. W. Dodge Company. The total amount of contracts awarded last month totaled $177,365,000, an increase of 7% over January, and the second largest February total on the Dodge company's records. A significant feature of the February construction record is the increase in business buildings over January. The increase in space contracted for was 30%, and the increase in total cost was 65%. February business buildings amounted to $39,180,000, or 22% of the month's total, an unusually high percentage for this class. In New England, the contracts awarded during February came to $15,623,000, more than double the amount for February, 1921. In New York State and northern New Jersey the figures were $59,328,000, the largest recorded February

Every Industry

Has its Peculiar Ventilating Requirement in Warm Weather

During the next six months there will be a demand for correct and economical ventilation which

ILG Self-Cooled Motor Propeller Fans and Universal Blowers

can furnish at a "most nominal" cost

Send for new indexed catalog fully illustrating modern heating and ventilating apparatus

GOOD HEALTH WEEK Oct. 23-30 1922

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY

Ventilation FOR OFFICES · STORES · FACTORIES · PUBLIC BUILDINGS RESTAURANTS · THEATRES · HOUSES · ETC.

ILG ELECTRIC VENTILATING CO., 2858 NORTH CRAWFORD AVENUE, CHICAGO, ILL.

Architects—Geo. B. Post & Sons, New York City
Engineers—Tenny & Ohmes, New York City

A Close Up

of the New Statler Hotel in Buffalo would look like this

The Signs Speak for Themselves

Buffalo Forge Company Buffalo Steam Pump Company
Carrier Air Conditioning Company of America
Buffalo, N. Y.

total for the district. It is 2½ times the total for February, 1921. In the middle Atlantic States, there was an increase of 13% over January and 67% over the corresponding month of last year. The total was $27,387,000. Pittsburgh also showed an increase of 28% over February, 1921, with figures of $24,881,000. In the Central West, building contracts, amounting to $45,258,000, were 39% ahead of February, 1921. In the Northwest the total, $4,886,000 represented an increase of 62% over the figures for February, 1921.

The Constructor is the new title of *The Bulletin* of the Associated General Contractors. It is stated that there will be no change in the editorial policy of the publication, but that the change in name "is indicative of the fact that the monthly magazine of the Associated General Contractors is no longer merely an official bulletin; it has established its place among the natonal construction journals of the country." It will remain, however, the official national publication of the Associated General Contractors of America.

American Institute of Chemical Engineers will hold its summer meeting at Niagara Falls, June 19-22. Headquarters will be at the Clifton Hotel.

Boston, Mass.—Plans are practically complete for the holding of the "Home Beautiful" Exposition in Boston, April 15-29, in the Mechanics' Building. Chester I. Campell is the manager.

Boston, Mass.—Willis H. Carrier, president of the Carrier Engineering Corporation, Newark, N. J., was the principal speaker at a joint meeting of the Boston Section, A. S. M. E., Textile Professional Session, A. S. M. E., and the Massachusetts Chapter of the American Society of Heating and Ventilating Engineers, at the Engineers' Club, Boston, March 16. His subject was "Engineering Problems Involving Atmosphere Moisture." The meeting was arranged through the executive committee of the Boston Section, A. S. M. E., headed by Alfred S. Kellogg, chairman.

Wisconsin Industrial Commission held a one-day conference on heating and ventilation in the assembly chamber of the Capitol Building, in Madison, March 22. The purpose of the conference was to offer an opportunity for the discussion of the heating and ventilation of public buildings and places of employment as influenced by present regulations of the Industrial Commission. Opportunity was offered to sponsors or designers of any special systems of ventilation to submit data and statements for the consideration of the commission.

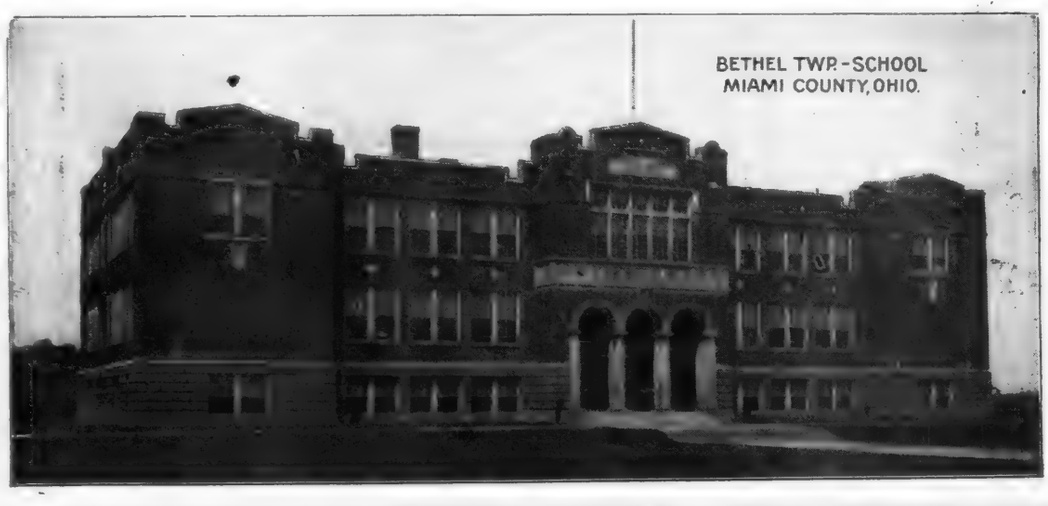
National Warm Air Heating and Ventilating Association will hold its eighth annual convention in Cleveland, O., April 19-20, 1922. Headquarters will be at the Hotel Winton. Among the interesting items on the program are: "Capacity Ratings of Furnaces," by J. M. McHenry; "Report of Advisory Committee on Warm-Air Furnace Research," by P. J. Dougherty, chairman; and "What Next in Warm-Air Furnace Heating?" by Professor J. D. Hoffman. A report will also be presented by Director A. C. Willard and his assistant, S. V. Day, on "Association Research Work at the University of Illinois." "Functions of Humidity" will be discussed by A. P. Kratz.

Factory workers, according to an announcement of the National City Bank, of New York, now, for the first time, exceed those engaged on the farms.

Washington, D. C.—A conference was announced by the Department of Commerce, to be held in Washington, April 12, to procure a list of trade associations that will furnish voluntarily to the Department of Commerce the classes of statistical information outlined in recent correspondence between the Department of Commerce and the Department of Justice; also to discuss methods for collecting certain statistical information and to discuss means and methods for distributing the information collected to the members of the association and to the public.

Washington, D. C.—Under the title of "Big Year for Home Builders Predicted," the Department of Commerce states that its Division of Building and Housing, after studying reports of contracts awarded, analyzing figures on building permits and consulting with builders and real estate men from scores of cities, concludes that before the year is out the United States will have begun to reduce its housing shortage of about 1,000,000 homes.

National Association of Manufacturers will hold its 27th annual convention in New York, May 8-10, 1922, with



THE LARGEST CENTRALIZED SCHOOL BUILDING IN THE STATE OF OHIO
equipped with
BUCKEYE FANS AND SPECIALTIES
We furnished the fans, dampers, registers, grilles, and faces for the above building
Why not use our catalogs and prices?
BUCKEYE BLOWER COMPANY
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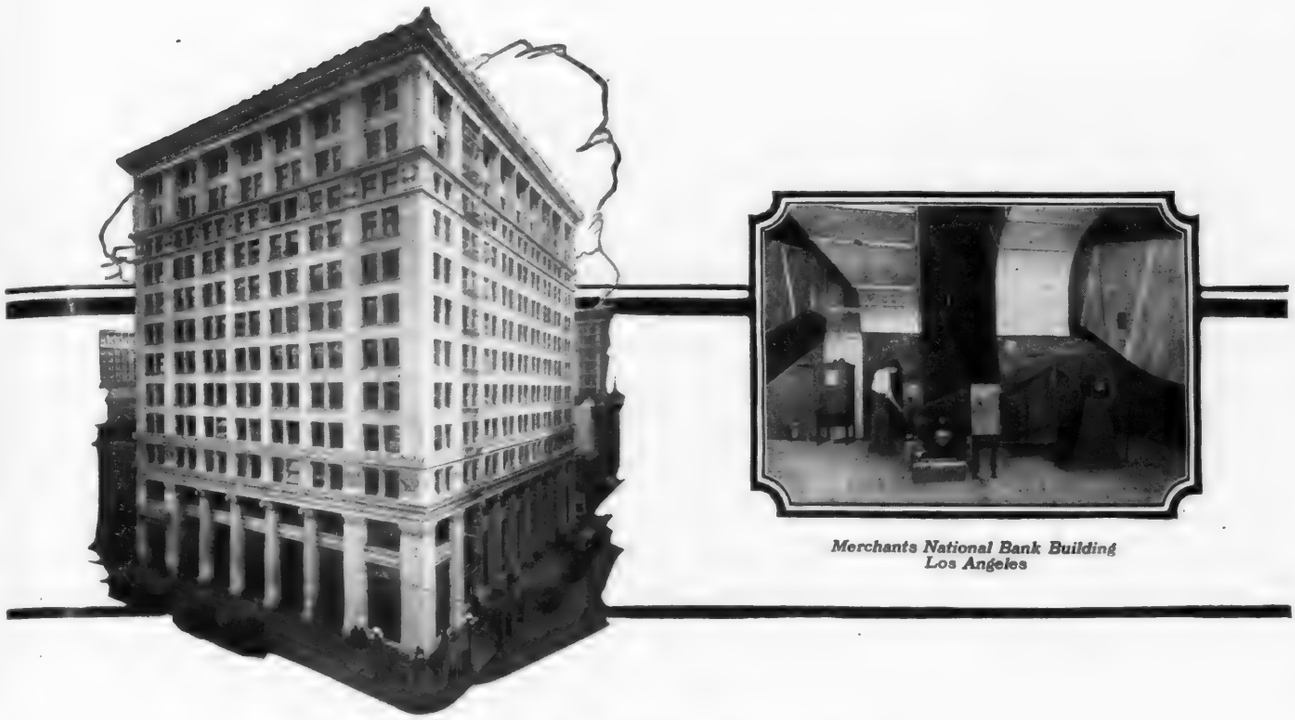
Chicago, Ill.



Merchants National Bank Building
Los Angeles

"Sirocco" Ventilation is Correct Ventilation

"Sirocco"—according to the dictionary—is a "hot, relaxing wind which rises in the Sahara Desert, then blows across the Mediterranean Sea."

"Sirocco"—according to scores of engineers, architects and managers of large private and public buildings—is a most efficient and economical system for providing pure, fresh air—in ample volume—warmed or cooled to the proper temperature.

"Sirocco" Fans, which are utilized everywhere for ventilating all types of structures, are designed and constructed to maintain the high standards of quality and reliability characterizing all products built by the American Blower Company. Every fan is built to merit the confidence and faith which heating and ventilating engineers have placed in products bearing the "Sirocco" name.

We will gladly send you our bulletin describing "Sirocco" products especially adaptable for heating and ventilating service.

AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

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"Sirocco" Products

BLOWERS · EXHAUSTERS · VENTILATING FANS · AIR WASHERS · ENGINES

FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

headquarters at the Waldorf-Astoria. The first part of the program will be devoted to the collection of detailed information describing the activities of the various national trade associations. The other part will be given over to addresses on various phases of the association question as it relates to business.

Plumbing, Steam and Metal Salesmen's Association of Maine held its fourteenth annual "round-up" March 13, at the Dundee Inn, Dunstan, Me. At the main event, which took the form of a shore dinner, President E. C. Mann acted as toastmaster. Forty-five members were present.

Central Station Heating Notes.

Clinton, Ill.—Following the denial by the Public Service Commission of the petition of the Clinton Gas & Electric Company for an increase in its steam heating rates, the company has announced its decision to discontinue the supply of steam heat to the business district and to hundreds of residences in that city. At an emergency meeting of the city council it was decided to send a committee to Springfield to ask a hearing before the Illinois Commerce Commission in an effort to prevent the discontinuance of the service. The position of the company is that repairs must be made at once to insure a dependable plant and these repairs will cost in excess of $20,000. The company, it is maintained, cannot make these repairs at the present rates for steam heat.

Winnipeg, Man.—The establishment of central heating plants under civic ownership and control is believed by S. C. Oxton, deputy minister of public works in the Provincial Government, to be a solution of the problem of heating Winnipeg buildings. Mr. Oxton bases his opinion on the record of the Provincial Government's central heating plant, which now heats the parliament buildings.

Bloomington, Ill.—Objections to the proposed change by the Bloomington and Normal Railway & Light Company from hot water to steam heat were made at a recent meeting of the Bloomington city council, by a delegation of consumers, represented by A. E. Demange. Mr. Demange, it was stated, was given the original franchise for the service in 1901. It was a 30-year franchise, he said, so that the present company is obligated to continue the service for ten years more. This point was brought up because of a circular sent out by the heating company in which it was stated that there would be no definite promise as to future service in case the change was made from hot water to steam. It was also brought out that some years ago the Bloomington and Normal Railway & Light Company purchased the Consumers' Heating Company, a company furnishing steam heat, as a leverage to force the City District Heating Company to sell its 30-year franchise. This was accomplished successfully and since that time, it is said, the company has discouraged the use of hot water.

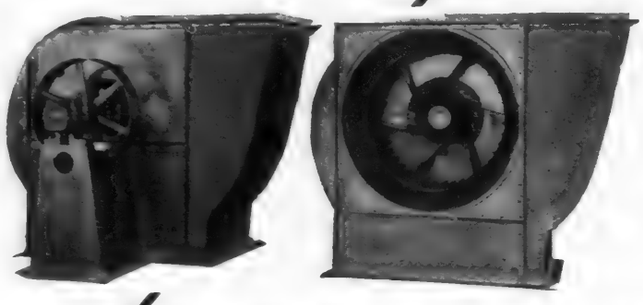
Iowa Falls, Ia.—The Iowa Falls Electric Co., Iowa Falls, Ia., suffered a loss of between $2,000 and $3,000 recently when high water covered its motors and pumps, making it necessary to shut off both power and heat.

Newcastle, Ind.—Abandonment of the Interstate Public Service Company's Central Station water heating system in New Castle at the end of the year following this is expected as the result of the conference on this subject, held March 2 between executives of the company and representatives of the users of heat in Newcastle. The condition of the underground lines is given as one of the principal reasons for ending the service. Central station heat, with hot water as the heading medium, is furnished on a large scale to the business buildings of the city and its discontinuance will mean a big total expenditure in the installation of individual heating plants. It is maintained by the consumers that the rates for electric current charged by the company are "higher than those in other cities and, for power especially, amount to more than the entire cost of operating the heating plant."

Tuscola, Ill.—There is a movement on foot in Tuscola to build a municipal district heating plant in that city during the coming summer.

Tacoma, Wash.—Some interesting facts regarding the successful operation of the Consumers' Central Heating Company's plant in Tacoma are given in a report from that city which states:

The Consumers' Central Heating Company is operated, owned and controlled exclusively by Tacoma men and was built by Tacoma labor. The central station steam



LEHIGH

MULTIBLADE FANS

Where large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior, to any other fans on the market.

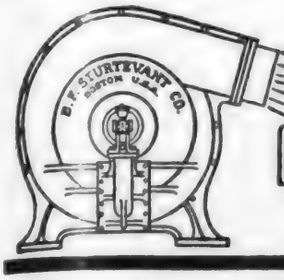
A study of the capacity tables and characteristic curves in the Lehigh catalogue clearly proves this fact.

To further substantiate this statement, your attention is directed to the large inlet and outlet, the cone shaped hub, the absence of stay-rods, the rigid construction secured by special blades running tangent from the hub to the periphery of the wheel and also various other details.

May we send you a copy of our catalogue?

HERSH BROTHERS CO.

654 Mill Street **ALLENTOWN, PA.**



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PUTS AIR TO WORK

HYDE PARK MUNICIPAL BUILDING, BOSTON, MASS.
DESMOND & LORD, *Architects*

THIS is a type of building rapidly coming into favor in all parts of the country—a combination of municipal offices and community hall. Ventilation is of first importance in the full use of these buildings. It is significant that in the Hyde Park Municipal Building, which is a model of its kind, the architects chose

Sturtevant Equipment

to provide ventilation. Its long life and efficient service match the sturdy character of the building and justify the architect's specification.

Qualified engineers in our twenty-four branch offices are always ready to give technical advice on your heating and ventilating problems

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASS.

STURTEVANT BRANCH OFFICES

ATLANTA, GA.
300 Walton Bldg.

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BUFFALO, N. Y.
100 Bedford Ave.

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CINCINNATI, OHIO
610 4th National Bank Bldg.

CLEVELAND, OHIO
430 Guardian Bldg

DALLAS, TEXAS
3411 Knight St

DETROIT, MICH.
3000 Grand River Avenue

HARTFORD, CONN.
36 Pearl Street

KANSAS CITY, MO.
707 Mutual Bldg.

LOS ANGELES, CALIF.
411 Hollingsworth Bldg.

MINNEAPOLIS, MINN.
804 Met. Life Bldg.

NEW YORK, N.Y.
52 Vanderbilt Ave.

PHILADELPHIA, PA.
135 No. Third St.

PITTSBURGH, PA
711 Park Bldg.

ROCHESTER, N. Y.
1024 Granite Bldg

ST. LOUIS, MO.
2080 Railway Exch. Bldg.

SALT LAKE CITY, UTAH
818 McIntyre Bldg.

SAN FRANCISCO, CALIF.
759 Monadnock Bldg

SEATTLE, WASH.
1105-1100 White Bldg

WASHINGTON, D. C.
1006 Loan & Trust Bldg.

B. F. STURTEVANT CO
OF CANADA, LTD.
GALT, ONT

MONTREAL
404 New B rks Bldg

TORONTO
210 Lumsden Bldg

plant and underground distribution system represents over $750,000 investment in Tacoma's industrial and business district. The steam distribution pipes extend from Dock Street to Court C, and from 13th Street to the Elks' Club, heating approximately 30,000,000 cu. ft. of space. Not only does the direct consumer benefit by this modern central station steam system, but the city in general materially benefits also. For example:

It eliminates the smoke and soot nuisance, also ash and coal dust in circulating air.

It reduces fire hazard to a minimum.

Local labor is used in all construction, operating and maintenance work.

It adds a large amount of assessible property to the city tax rolls.

The Consumers' Central Heating Co. has solved in a large measure an economical problem in that approximately 98% of its annual turnover is expended within the city of Tacoma. All fuel used in its central station steam plant is furnished by local sawmills, being waste refuse heretofore consumed in burners maintained by these mills at great expense.

Manufacturers' Notes.

Marsh Valve Co., Erie, Pa., manufacturer of radiator valve and mill supply brass valves, globes, angles and gates, announces that constantly increasing business has made it necessary for the company to enlarge its manufacturing facilities. The company has therefore purchased a new plant in Dunkirk, N. Y., 40 ft. x 200 ft., brick and steel fireproof construction, located on a seven-acre site near the business center of Dunkirk. It is proposed to make this the first unit of a larger layout. For the present the company's foundry work will be done outside under contract and the new building will be devoted entirely to machining and assembling. The company has recently increased its cash working capital $100,000. W. C. Marsh is president.

American Radiator Co., Buffalo, N. Y., according to an announcement in *Printer's Ink* for February 23, is using 150-line advertising copy in newspapers directed at the bankers through whom loans for the purchase of homes are negotiated. The company states that "a home with modern steam or hot water warmth rents for more and sells for more." The purpose is evidently to make loans easier to procure on those properties with such heating systems, and so give an incentive for the builder to install such systems.

SALES FORCE OF UTICA HEATER COMPANY IN ATTENDANCE AT COMPANY'S ANNUAL CONVENTION.

Utica Heater Co., Utica, N. Y., whose annual convention was reported in last month's issue, carried out a program which might well serve as a model for such gatherings. In addition to talks on warm-air furnace topics, there were two boiler sessions, in which such topics were dis-

AIR CONDITIONING TRADE MARK

APPARATUS for maintaining artificial atmospheric conditions in industrial plants.

ATMOSPHERIC CONDITIONING CORPORATION
LAFAYETTE BLDG.
PHILADELPHIA

American

Gauges; Gauge Testers; Steam Engine Indicators; Steam Traps; Feed Water Filters; Recording Thermometers, Pop Safety and Relief Valves; Whistles; Counters and Clocks are backed by 70 years' experience. Write for Catalog No. 70.

American Steam Gauge & Valve Mfg. Co.
Boston, Mass.
Branches in Large Cities

Vento Return Line Valve

for Vacuum and Vapor Heating Systems is a fuel-saver from the moment that it is put to work on the heating system. It never fails in its promise to make the heating system give dollar-for-dollar service for every ounce of fuel consumed. Our latest Booklet, "The Perfect Heating System," will be mailed on request to any heating engineer.

WM. S. HAINES & COMPANY
PHILADELPHIA

Steam Traps Steam Separators Oil Separators Strainers
Air Traps Exhaust Heads Boiler Alarm Water Columns

WRIGHT AUSTIN

WA Standard with STEAM USERS SINCE '94

WRIGHT-AUSTIN CO. DETROIT, MICHIGAN

Peerless Ventilator

BUILT RIGHT RUN RIGHT

The New York Blower Co.

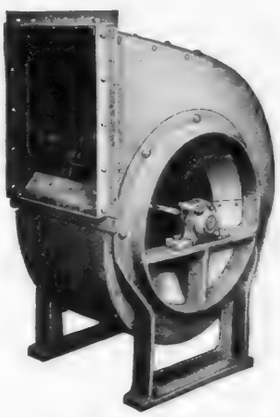
Chicago, Ill. La Porte, Ind.

Peerless Air Washer

We manufacture a complete line of fan equipment and appurtenances. By concentrating on this one class of products we are able to make them better every year.

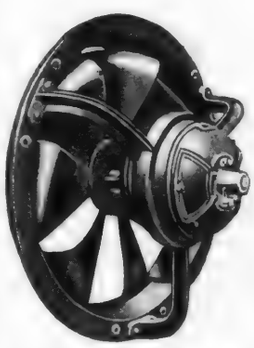
Pulley Driven Disc Fan for Mines

The old fallacy that fan equipment was a luxury is now known to be untrue; it is an economical necessity. We can give actual installations in all kinds of industries where through the wise employment of fan equipment manufacturers have improved the quality of their product, and increased production with a reduction in factory cost.



Type "C" Seri-Vane Fan

If you are interested in drying, humidifying, heating, ventilating, mechanical draft, removal of shavings or similar installations, please communicate with us. If we cannot honestly prove facts to you showing the benefits that will follow from an installation for your special problem, we will frankly so state.



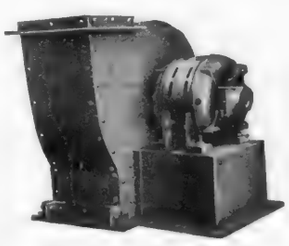
Motor Driven Propeller Fan

Slow Speed Planing Mill Exhauster

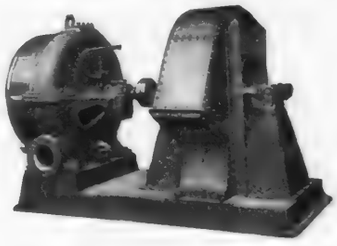
The New York Blower Co.

Chicago, Ill. La Porte, Ind.

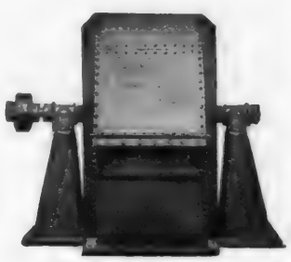
Branch Offices in Principal Cities



High Speed Type "C" Seri-Vane Fan



High Pressure Blower Direct Connected to Turbine



Stoker Fan

cussed as "The Super-Smokeless Boiler," by James Doherty; "Selling the Steam Heating Contractor," by F. L. Bunton; "Architects and School Boards," by James J. Mason and "Engineering Information," by J. K. Norris. In addition Russell Doherty's talk on "Trouble Jobs" struck a live chord, while the talks of J. G. Steiner on "My Experience in Selling the Super-Smokeless" and the remarks of C. E. Hodges on "Imperial Sectional Square and Round Boilers" were both of the most practical nature. The accompanying group view of the representatives was taken during the convention.

Boynton Furnace Co., New York, has moved to a new location at 58 West 40th Street. This, it is stated, is the company's second removal in 60 years. Its former place of business on West 37th Street is being demolished to make way for a 16-story office building.

American Radiator Co., Buffalo, N. Y., has appointed D. E. Kennedy, formerly assistant general manager of sales, as manager of the Chicago branch. Milo Dillman has been transferred from Chicago to Baltimore where he will have charge of the Baltimore branch. W. M. Scudder, formerly manager of the Chicago branch, has been appointed assistant to the vice-president. The company's Philadelphia office has been moved to 25th and Wharton Streets where the company's local warehouse is located. A showroom will be maintained at 1711 Chestnut Street. W. A. Bland is manager of the Philadelphia branch.

Nye Tool & Machine Works, Chicago, Ill., has increased its manufacturing facilities by leasing an additional floor at 108-128 North Jefferson Street, where the company's main offices are located. The additional space provided is about 10,000 sq. ft.

Gurney Heater Mfg. Co., Boston, Mass., has moved its executive offices and show rooms to 93-97 Oliver Street, Fort Hill Square, Boston. The company has been located for many years at 188-200 Franklin Street.

New Firms and Business Changes.

Eastern Heating Corporation, 1133 Broadway, New York, is one of the recently-incorporated piping and heating contracting companies of New York City. The president and general manager is William H. Smead, with whom is associated Henry E. J. Schiffer, who has direct supervision of the company's heating and plumbing installation work. Both men have been connected with the contracting business for the past 20 years in various parts of the country. The new corporation's activities, however, will be concentrated in the metropolitan district. At present the corporation is handling the heating and plumbing equipment for the American Book Company's new publishing plant in Bloomfield, N. J., several residences in Pelham, N. Y., and the new bank building of the Brevoort Savings Bank, in Brooklyn.

J. M. Connaughton Plumbing & Heating Co., Wichita, Kan., has been established by J. M. Connaughton, who has sold his interest in the Ideal Plumbing & Heating, of that place, to E. V. Nelson.

New Incorporations.

American Boiler Tube Thimble Co., Providence, R. I., capital $50,000. Incorporators: Edward F. Martin, Martin E. Murray, of Providence; William J. Green, Cranston; and John D. Cameron, East Providence, R. I.

McIlvaine Vaporizer Co., Rockford, Ill., capital $200,000, organized to market a new heating device for domestic use. Incorporators: John H. McIlvaine, George B. Johnson, and Samuel Shaffer, Chicago; and George D. Roper, of Rockford. The device is intended for use with kerosene oil as the fuel. A model is on display at the plant of the George D. Roper Corporation, in Rockford, where the device is being manufactured.

Caloric Heating Co., Cincinnati, O., capital $10,000. Incorporators: Edward F. King, Strauder Jackson, Clifford Carberry, H. Pope and John Schraer.

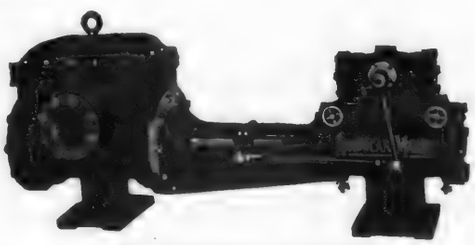
Contracts Awarded.

Sanitary Engineering Co., Fort Fayne, Ind., heating and ventilating new South Side High School building, in that city. The heating plant will be located in a separate building. The main building will occupy an area of 450 ft. x 226

American-Marsh Pumps

for Heating Systems

For use in returning the condensation to the boiler on heating systems where the steam pressure is too low to operate a steam pump. Water is returned to the boiler in its hottest state. Equipped with an automatic float valve which is positive and reliable



The Recognized Standard

American-Marsh Vacuum Pumps have been recommended and specified by a majority of the leading heating engineers and Contractors for over twenty years.

Made with only best of material and workmanship. Highest efficiency guaranteed.

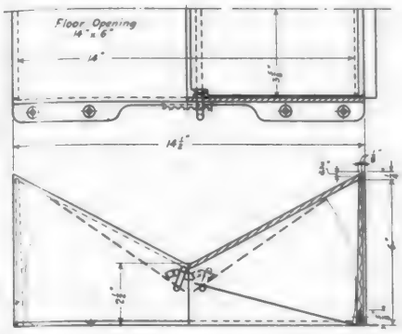
Equipped with an improved steam valve which is especially adapted for vacuum service. American-Marsh Pumps are positive in action, possess a perfect governing element and will not hang up under all the varying conditions.

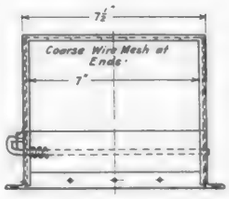
Ask for Bulletins Nos. 24 and 27

AMERICAN STEAM PUMP CO.

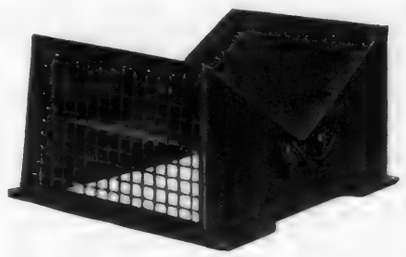
Battle Creek, Mich.

Our slogan: Simplex not Duplex. "To be simple is to be great"





"Camelback" Air Diffuser



The Comfortable Theatre

Is as much responsible for the remarkable growth of the moving picture business as any other one factor.

The Knowles Fresh Air Diffusers have greatly contributed to this comfort.

The public will favor with its patronage those auditoriums which are properly ventilated.

Economical and positive **DISTRIBUTION** of fresh air is important.

The "CAMELBACK" Air Diffuser is something comparatively new but already architects and heating and ventilating engineers have found that by its use the desired volume of fresh air is introduced and distributed throughout the auditorium at a minimum of cost and friction loss.

BECAUSE

1. Less duct work is required, saving a great expense in masonry.
2. Its construction of two-way air delivery at ends, permits the discharge of the maximum quantity of air with the minimum number of diffusers.
3. Its angular shape makes it uncomfortable as a foot rest.
4. Friction loss is negligible.
5. It admits of the use of the lowest slung chair seat.
6. It is made of heavy cast iron with wire screen over ends, and is guaranteed to last.
7. It has two controlling dampers, regulated independently of each other and is furnished without dampers if desired.

BLUE PRINTS AND PRICES ON REQUEST.

KNOWLES MUSHROOM VENTILATOR CO.

202-204 Franklin St., Phone Walker 6967, New York City

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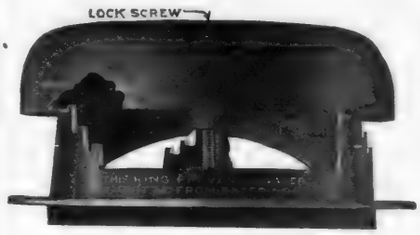


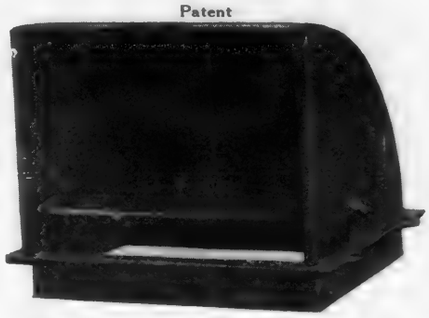
The Famous Knowles "Notch" Air Diffuser.

Note the recessed notches which cannot slip, and that there are no set screws to become loosened.

Also manufacturers of the two best selling air heads on the market.

Original— Simple— Reliable

Patent



Knowles Aisle Hood Air Deflector.

Note the curved damper which permits the easy flow of all the air.

ft. and will be designed to accommodate 1500 pupils.

William H. Conklin Co., Toledo, O., heating and ventilating Hamilton School building for $23,488. The boiler contract went to the Bryce Heating & Ventilating Company, at its bid of $10,609, and the temperature-regulating contract to the Colby-Merrill Company, at its bid of $8,217.

Theodore M. Barr, of Salem, Ore., and Rushlight & Hastorf, Portland, Ore., were the lowest bidders for the installation of a ventilating system in the State House. Mr. Barr's bid was $14,718 and that of Rushlight & Hastorf, $14,492. The legislature appropriated $18,000 for this work.

Delahunty & Co., Decatur, Ill., heating and ventilating new combined high and grade school in Taylorville, for $25,000. The total cost of the building will be $119,222.

Victor Piping Co., Chicago, Ill., heating and ventilating armory building, in Danville, Ill., for $21,018; the plumbing contract went to the Carson-Payson Co., of Danville, at its bid of $8,669.

Linehan & Molo, Dubuque, Ia., heating and ventilating the two junior high schools in Dubuque for $56,428. The total expenditure for the two buildings will be $409,902.

Business Chances.

Washington, D. C.—Proposals were opened April 10, 1922, at the office of the Supervising Architect, Treasury Department, for the installation complete of the mechanical equipment for the central heating plant, outside services and 19 hospital buildings at the United States Veterans' Hospital No. 24, Palo Alto, Cal.

Typical Instance of Drop in Construction Cost

Bids recently opened by Architect W. L. Alban of St. Paul, Minn., for the construction of a junior and senior high school to be built in Olivia, Minn., showing a decided reduction in cost, are reported in the *American School Board Journal*. The comparative prices on bids taken in 1920 and 1922, figured on the same basis, showed the following:

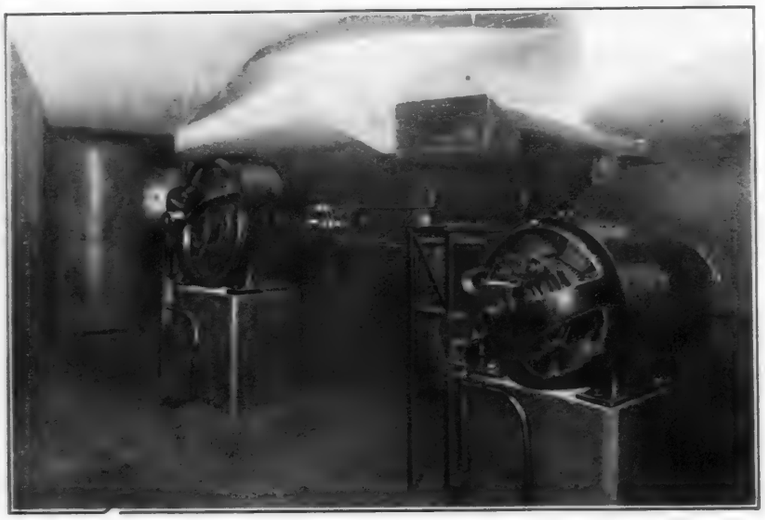
	1920	1922
Date of Taking Bids	April 30	Jan. 26
No. of Bidders, General Construction	5	19
No. of Bidders, Heating and Ventilating	4	18
No. of Bidders, Plumbing	4	16
No. of Bidders, Electric	3	15
General Construction Bid	$166,760.00	$ 98,100.00
Heating and Ventilating Bid	22,490.00	16,573.00
Plumbing	11,698.00	8,552.00
Electrical Work	5,760.00	3,800.00
Total Cost	$206,708.00	$127,025.00
General Construction per cu. ft.	$.2529	$0.1416
Mechanical Work per cu. ft.	0.0606	0.0418
Total	$0.3135	$0.1834
General Construction, percentages	100%	56%
Mechanical work, percentages	100%	69%
Total Building	100%	58½%
Compared with 1916 prices (taken at 100%)	209%	122½%

The above is a comparative analysis of bids taken in 1920 and in 1922 on the same building from same plans and specifications. Amounts of bids have been rectified so as to bring both on same basis. The results show that building costs in general are 41½% lower than in 1920 and but 22% higher than in 1916.

National Construction Conference in Chicago.

As we go to press the National Construction Conference is beginning its sessions in Chicago, April 3-5, at the Drake Hotel. The conference which is being held under the auspices of the National Federation of Construction Industries, has the coöperation of a number of govern-

Sprague Blower Motors



Typical Installation of Sprague Motors and Controllers operating Ventilating Equipment in the Cunard Building New York City

Slow Speed Sprague Blower Motors Driving Sturtevant Fans

SPRAGUE ELECTRIC WORKS
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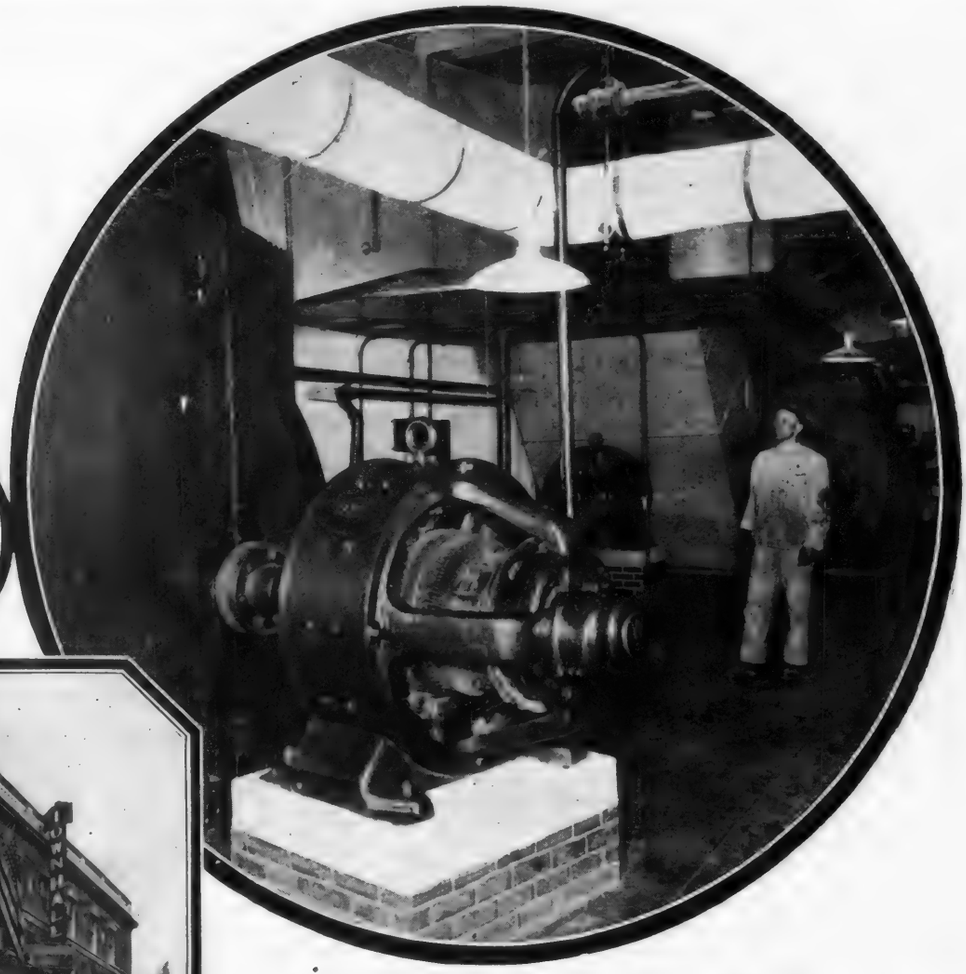


The Townhall of the League for Political Education, New York City.

Another New York Installation

The Town Hall for the League of Political Education is another of New York's recent structures in which the ventilating equipment is Westinghouse Motor-Driven.

Together with the Bankers' Trust Building, the Seaboard National Bank and the Mt. Siani Hospital, it represents a list of New York's latest and finest buildings. All are Westinghouse Equipped.

Westinghouse has a complete line of ventilating motors of all sizes, styles and types that are applicable to all industrial, private or public ventilating systems.

Westinghouse Electric & Mfg.Co.
East Pittsburg Pa.

Offices in all Principa l American Cities

Westinghouse

ment departments and bureaus, as well as other construction organizations. On the evening of April 6 a great construction industry dinner was scheduled at the Drake Hotel.

A New Recording Thermometer.

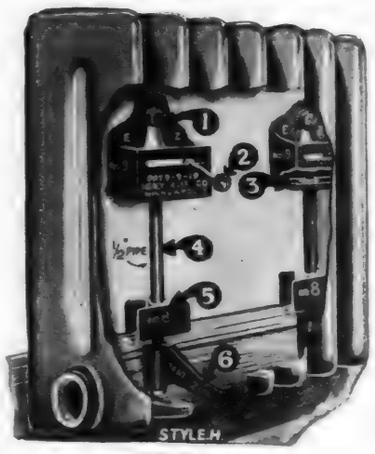
Another new recording thermometer, which has recently made its appearance on the market, is manufactured by the American Steam Gauge & Valve Mfg. Co., Boston, Mass. In this instrument different actuating mechanisms are used, depending on the purpose for which it is to be used. One of its noteworthy features is a chart button which enables the chart to be removed by giving the button a quarter turn, and prevents loss of the button. A pen lifter automatically raises the pen from the chart when the door is opened. These instruments can be furnished for any desired temperature range up to 1000° F. For the greater part of this range and a majority of industrial applications, the pressure of saturated vapor is used as the actuating medium. For temperatures above 500° F., for extremely short ranges, and also for very low temperatures, such as that of brine, the expansion of an inert gas forms the actuating element. The expansion of various liquids is also made use of in certain cases.

The instruments are made in one standard size, having a 10-in. chart, and in one style of case which is described as moisture-and dust-proof.

KELLOGG-MACKAY COMPANY'S EXHIBIT AT KANSAS CITY BUILDING SHOW

One of the heating and plumbing exhibits which attracted attention at the recent "Better Homes and Building Exposition," in Kansas City, was that of the Kellogg-Mackay Co., of Chicago. In addition to some up-to-date plumbing fixtures, such as a combination three-in-one bath tub, the display included a complete heating installation showing the O-E Perfect vapor, vacuum and pressure heating system. The figures in the illustration, from left to right, are R. J. Laurie, C. E. Gay and Frank Griffon, heating engineers with the Kellogg-Mackay Co.

SIX IMPORTANT FEATURES of *E-Z* RADIATOR HANGERS



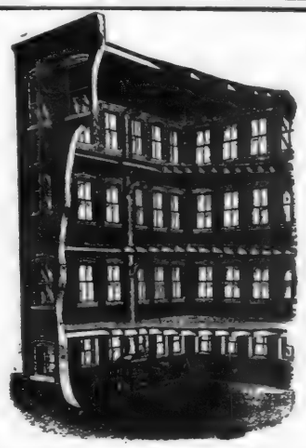
STYLE H

1. One Bolt
2. Invisible Washer
3. Horizontal Adjustment
4. Vertical Adjustment
5. **Adjustable for Baseboard**
6. Made for Wall, and Column Radiation

STYLE R
Without Baseboard Adjustment
Reasonable Price

Made for all styles of radiation

Manufactured by
HEALY-RUFF CO.,
Minneapolis, Minn.

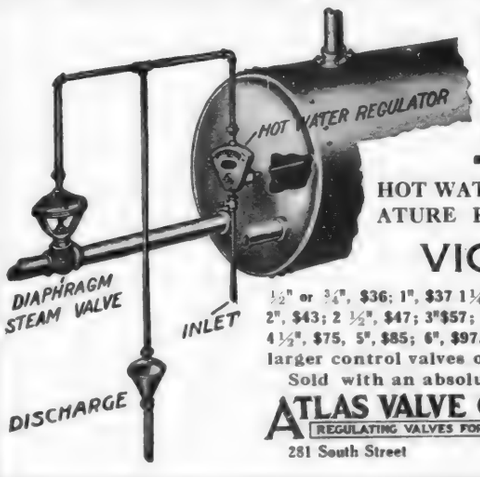


PORBECK INDUSTRIAL AIR HEATER

Adapted for heating and ventilating large buildings. No need of distributing pipes. Takes full advantage of the laws of nature in the production of warmed air and utilizes these laws in providing an even distribution of warmth and comfort throughout the largest of buildings.

Sales representatives wanted

PORBECK MFG. CO.
1000 N. Market St., St. Louis, Mo.



NET PRICES

HOT WATER TEMPERATURE REGULATOR

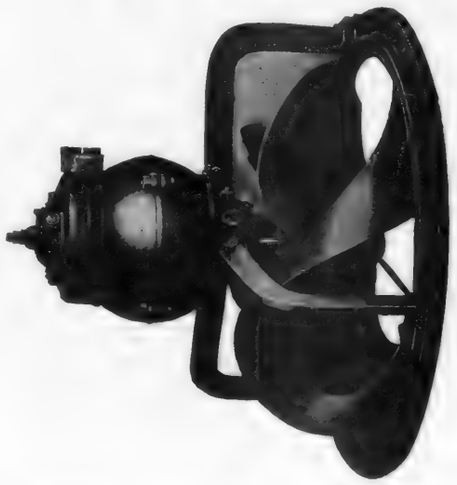
VICTOR

½" or ¾", $36; 1", $37 1¼" $40; 1½", $41.50; 2", $43; 2 ½", $47; 3"$57; 3 ½," $62; 4", $67; 4½", $75, 5", $85; 6", $97.20. Prices with larger control valves on application.

Sold with an absolute guarantee.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
281 South Street Newark, N. J.

MASSACHUSETTS DAVIDSON PROPELLER FANS



Are especially suitable for handling large volumes of air at low resistances.

Massachusetts Blower Co.
Watertown, Mass.
Sales Offices in Principal Cities

The DUNHAM HEATING SERVICE
REG TRADE-MARK

3 Tested Systems

The Dunham Home Heating System. For homes and small buildings. It uses steam at very low pressure, not over 8 ounces.

The Dunham Return Heating System. For medium sized buildings. Any pressure up to 10 pounds. Operating pressure of 1 to 2 pounds recommended.

The Dunham Vacuum System. For all types and sizes of buildings. Any pressure up to 10 pounds. A vacuum pump maintains a vacuum in the return piping.

Each of the above is a complete two-pipe system, made efficient by use of the Dunham Radiator Trap. Bulletins describing any of these systems on request.

C. A. DUNHAM COMPANY
230 East Ohio Street, Chicago
52 Branch and Local Sales Offices in United States and Canada

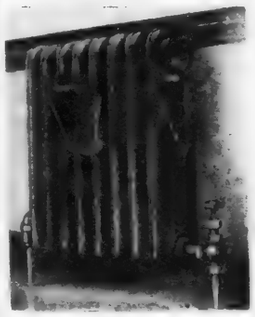
Fig. 2176

Automatic Electric Condensation Pumps

Economy Automatic Electric Condensation Pumps are compact, self contained. Constructed of highest quality materials obtainable. Simplicity and efficiency are the keynote of this design. The pump is bronze fitted, ring oiling, centrifugal type. The float is seamless copper, high pressure type. Everything is sufficiently strong to yield long life and light enough to make handling and installation easy.

ECONOMY PUMPING MACHINERY CO.
122-124 N. Curtis St. Chicago, Illinois

HARTMANN RADIATOR BRACKETS



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LABOR SAVED
NO WALL STRIPS
NO BREAKAGE
NO DIRT
INEXPENSIVE

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CHARLES HARTMANN CO.
Sheet Metal Constructors
985 Dean St., Brooklyn, N.Y.

Ross

Surface Barometric and Jet Condensing Equipments for Power Plants.
Main, Auxiliary, Distilling Condensers & Evaporators for Marine Service.
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Crosshead Guided" Expansion Joints
Ross Boiler Feed Water Heaters.
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Ross Oil, Air and Water Coolers.

ROSS HEATER & MFG. CO., Buffalo, N. Y.

THE BRAND THAT LEADING ENGINEERS DEMAND

Heating Appliances Included in a Plan for the Simplification of Building Materials

Simplification of building materials as a means of eliminating waste in industry was discussed at a recent conference held between officials of the Department of Commerce and representatives of architectural, engineering and building organizations. The Fabricated Production Department of the Chamber of Commerce of the United States is cooperating with the Department of Commerce and the industry in the movement.

The work of the meeting may be summed up in the following resolution which was adopted:

"WHEREAS the undersigned committee of architects, contractors and engineers are fully in accord with Secretary Hoover's program for elimination of waste as a major means to the stimulation of American business, and

"WHEREAS prominent among the many factors which contribute to such wastes in building as evidenced by the high cost of construction are the multiplicity of types and the great variety of dimensions which now abound in many of of the component parts which enter construction, and

WHEREAS the cost of construction will undoubtedly be thereby lessened, the industry stimulated, and interest of the public conserved by dimensional simplification;

"BE IT RESOLVED that this committee formed to discuss the subject of dimensional simplification recommends to the Department of Commerce that the Division of Simplified Practice study certain essential parts of construction with a view to simplifying the types and lessening the number of different dimensions of those parts."

In selecting the items of building materials to be given attention first, the following were designated: millwork, plumbing, heating, interior wall construction, hardware, lighting fixtures, clay products, the latter including brick, tile of all kinds, terra cotta, sewer pipe, etc.

In giving these items attention, the department will formulate sub-committees to bring together the manufacturers and others having to do with each particular commodity or service.

It is expected later that conferences of those manufacturing each of the commodities and all interested in these lines will be called from time to time, and it is hoped that within a reasonable time the work will have an important effect in stimulating building and reducing building costs.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

Position Wanted—All-round heating man desires position with responsible heating firm as estimator or superintendent. Twenty years' experience. 39 years of age. Available May 1. Address O. H., care of HEATING AND VENTILATING MAGAZINE.

Graduate Engineer, now employed as sales engineer, desires change. Has had extensive experience in design, operation and sales of heating and ventilating equipment. Address Graduate, care of HEATING AND VENTILATING MAGAZINE.

Wanted—Experienced steam heating and steam specialty salesman to represent long-established vacuum and vapor heating manufacturer. Commission basis. Some good territory open. Apply giving full experience, territory desired, lines carried, etc. Address National, care of HEATING AND VENTILATING MAGAZINE.

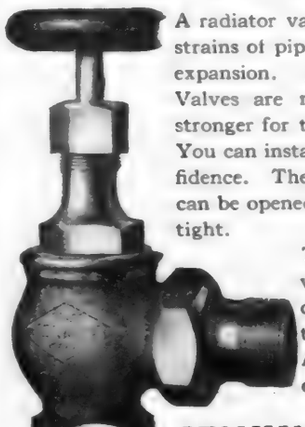
Sales Agency in Chicago.—The writer wishes to get in touch with manufacturers of power plant, heating and ventilating apparatus or specialties for Chicago territory. Drop me a line and I will outline the proposition. W. B. Crawford, 501 Tacoma Building, Chicago, Ill.

Wanted—District sales representatives to handle line of blast heating and ventilating and air conditioning apparatus as side line, or otherwise on liberal commission. State experience and qualifications. Address Box 12, care of Heating and Ventilating Magazine.

Position Wanted — First-class man, thoroughly experienced in all branches of heating and ventilating work, either field or office, engineering, estimating, closing contracts, purchasing and construction superintendence. Willing to fill temporary position anywhere for this season. Address Box 14, care of Heating and Ventilating Magazine.

TRADE JENKINS MARK Jenkins Bros

BETTER VALVES
for better heating



A radiator valve must stand the strains of pipe contraction and expansion. Jenkins Radiator Valves are made heavier and stronger for that purpose.
You can install them with confidence. They will not leak—can be opened easily and closed tight.

The enduring service of Jenkins Radiator Valves proves their economy.
At supply houses everywhere.

JENKINS BROS.

Fig. 168, Jenkins Brass Radiator Ang'e Valve with wood wheel and union

New York Boston Philadelphia
Chicago Montreal London

Jenkins Valves
SINCE 1864

First In Appearance Quality and Service

The new "Genuine Detroit" Packless Radiator Valves, Bellows Type, are the result of years of experience in the design and manufacture of Radiator valves.

They are a high grade product of handsome design and are built for long life and freedom from trouble.

Where other valves leak and result in damage to surroundings—they do not do so.

Manufactured in all necessary styles and sizes for steam, hot water, vapor and vacuum heating systems. Let us send you booklet giving full information.

DETROIT LUBRICATOR COMPANY.
DETROIT, U.S.A.

Cycloidal
MULTIVANE FANS
TRADE MARK

FULFILL THE OBLIGATIONS OF ENGINEERS AND CONTRACTORS TO THE USER.

Pat'd May 26, 1908

A GENUINE COMBINATION OF EFFICIENCY *AND* DURABILITY

The result of over 40 years of constant experience

A fact that demands your attention:—

"WHEREVER INSTALLED"

Cycloidal Multivane Fans Receive Unsolicited Praise and Recommendation from Architects, Engineers, Contractors and Users.

Sectional Catalog No. 20 is yours for the asking. Contains Capacity tables, dimensions, etc.

GARDEN CITY FAN CO.

Established 1879

McCormick Bld'g. CHICAGO, ILL.

COCHRAN & WRIGHTSON
47 W. 34th St.,
New York City

For many jobs—

especially theatres, factories and laundries—the low pressure Monsoon Multiblade Disc Fan is the ideal type.

Low in cost and power consumption, high in air volume. Equipped with SKF self-aligning ball bearings.

Monsoon Cooling System, Inc.
71 No. 6 Street, Brooklyn, N. Y.

BREATHE LAUNDERED AIR

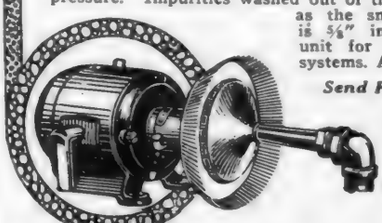
Clean, wholesome air, containing the proper proportion of humidity, conditioned to a comfortable temperature is absolutely essential in industrial, office, public and school buildings.

The Bayley Turbo Air Washer

Supplies pure air by passing atmospheric air through a dense water spray to eliminate impurities, and through a conditioning chamber to regulate temperature and humidity. Uninterrupted service is assured by an atomizer that

WILL NOT CLOG

The Turbo-Atomizer (shown in the circle) distributes a fine spray evenly through the spray chamber at low water pressure. Impurities washed out of the air will not clog it, as the smallest water passage is 5/8" in diameter. An ideal unit for replacing fine orifice systems. Also for washing gases.



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BAYLEY MFG. CO.
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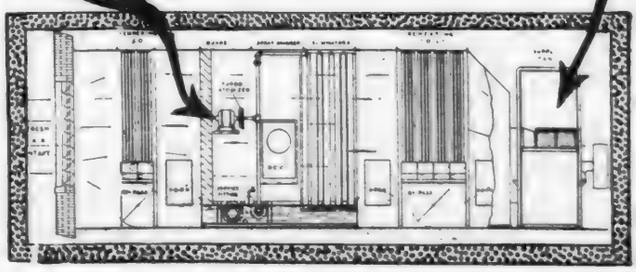
Milwaukee, Wis.



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100% FIREPROOF
HOT SURFACE INSULATION

Before deciding on your requirements of Heat Insulation, investigate the remarkable results obtained from Banner Rock Wool Quilt when used as insulation for Boilers, Heaters, Breechings, Kilns, Ovens, Tanks, Tankcars, Water and Oil Stills and other hot surfaces.

MANUFACTURED BY

BANNER ROCK PRODUCTS CO.
ALEXANDRIA, INDIANA

QUALITY HEAT AND COLD INSULATION

Twin Fire Hand Stoker

The Best Since 1898

Kill The Smoke and Get The Heat!

SMOKE means a lazy furnace,—wasting fuel, failing to deliver maximum heat and making a nuisance of itself. Since 1898, the famous

Twin-Fire
HAND STOKER
"It Burns the Smoke"

has been installed everywhere with the understanding that it will *double* the furnace temperature with *less fuel* over the ordinary setting: that it will save 10 to 30 per cent fuel, increase boiler power, eliminate dirty tubes and burn any grade coal. Twin-Fire Hand Stoker can be installed under boilers from 50 to 1000 H. P.

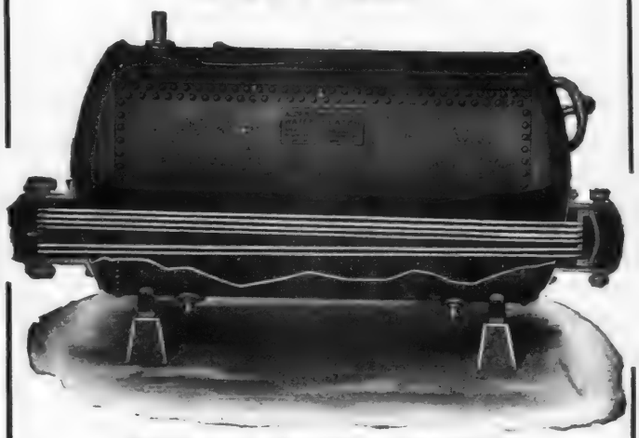
All this is due to Twin-Fire's *complete combustion*. Learn more about Twin-Fire. You owe it to yourself.

Send for New Illustrated Brochure

TWIN-FIRE FURNACE COMPANY
1253 1st. Nat'l. Bank Bldg., Chicago
"Successful Furnace Builders Since 1898"

Our reputation is too important to permit us to put out an untried product.

ALBERGER "BUFFALO"



STORAGE WATER HEATERS

have been thoroughly tested and can be used with confidence by engineers and contractors.

Write for catalogue filled with heater data.

Alberger Heater Company
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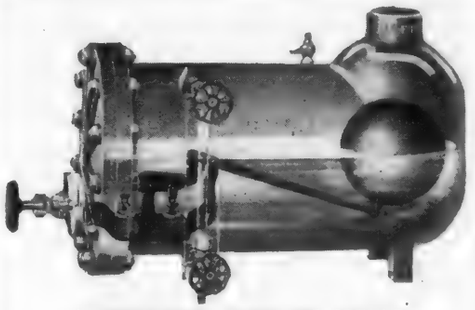
New York Offices: 1544 Woolworth Building



A BETTER STEAM TRAP —THE DAVIS

Dry steam is essential to heating systems if operation is to be economical. But dry steam is impossible if the steam lines contain water of condensation.

The Davis Steam Trap automatically keeps steam lines free of condensation—without loss of steam. Service is reliable; they have cone-shaped balanced valves that give unusually large capacity and that will not stick or clog; set in modern valves and seats are renewable—made of special bronze, non-corrosive and extra hard.

We will send you this better trap on the basis of satisfaction or money back. Write the G. M. Davis Regulator Co., 436 Milwaukee Ave., Chicago. Ask for description of complete line of specialties.

DAVIS VALVE SPECIALTIES

STEAM SAVERS SINCE 1875

TRADE MARK STERLING

The Sterling Slide Valve Return Trap

Patent applied for

Will thoroughly drain return lines of heating systems, eliminate air without loss of vapor and return water to the boiler against pressure.

It will lift liquids to a higher level where steam or air pressure is available.

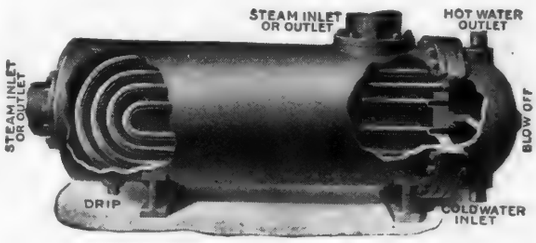
It can be placed as low as 3 inches above the water line of the boiler, thus making it possible to install vapor systems in basements with low ceilings.

A cure for sick Vapor Heating Jobs

STERLING ENGINEERING CO.

419 Third Street MILWAUKEE WISCONSIN

In Buildings heated by Hot Water—either gravity or forced circulating systems—



The Patterson Converter

guarantees most efficient results

Its compact construction with ample heating surface of "∩" shaped, seamless copper tubing, forged steel tube head, etc. ALL are Features.

With no obligation whatever, Heating Engineers may have the advantage of our long experience in designing such installations.

Send us the complete specifications

Patterson-Kelley Co.

23 Dey Street
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THE DOUGLASS HUMIDIFIER

STANDARD TYPE
Made in three sizes for direct connection to steam piping

Is attached directly to the steam heating system

Discharges dry steam noiselessly

Gives satisfactory results in any type of building equipped with steam

Inexpensive to install

Will not get out of order

No attention required

No maintenance expense

Made in various sizes and types to suit all conditions and requirements

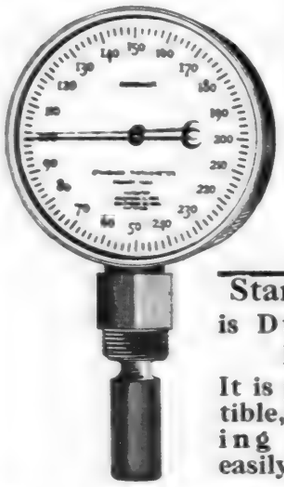
Illustrated catalogue sent on request

THOMAS J. DOUGLASS & CO.
441 N. Dearborn St.
Chicago, Ill.

RADIATOR TYPE
Is attached to steam radiator in place of the air valve. Made in one size only.

STANDARD "Metallic" THERMOMETERS

INDICATING AND RECORDING



ANGLE OR STRAIGHT STEM

WARRANTED ACCURATE

The Standard "Metallic" is Durable, Dependable EASY TO READ

It is practically indestructible, is sensitive to changing temperatures, and easily installed.

Made in a variety of sizes and models for vacuum, steam and hot water systems, bake ovens, cold storage plants and other industrial purposes. They are strictly high grade in every respect, and should be specified where quality is a factor. A line from you will bring booklets illustrating **Standard "Metallic" Thermometers.**

STANDARD THERMOMETER CO. CLIFTON ST. BOSTON 19, MASS.
Nearly Forty Years As Thermometer Manufacturers

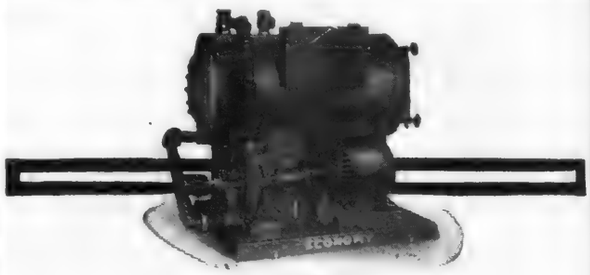


Fig. 2234

Automatic Centrifugal Vacuum and Boiler Feed Pumps

The Economy Centrifugal Vacuum and Boiler Feed Pumps will relieve you of the necessity of looking after a lot of details, for it includes everything used in the vacuum generating equipment of a heating plant.

It comes self-contained so that no time or labor is lost in connecting a number of individual parts. Only two connections are necessary; the return to inlet and boiler supply to the unique boiler feed valve which operates without the use of floats or buckets.

ECONOMY PUMPING MACHINERY CO.
122-124 N. Curtis St Chicago, Illinois.

OZONE PURE AIRIFIER

The installation of the "Ozone Pure Airifier" in connection with Fan systems of heating and ventilation in schools, theaters, banks and manufacturing plants, permits of re-circulation of a large percentage of the total air volume handled.

ADVANTAGES

Saving in Cost of Operation

1.—Reduction of 25 to 50% in coal consumption.

2.—Reduction in Steam Consumption.

Saving in initial Cost of Mechanical Equipment.

1.—Tempering coils may be omitted.

2.—Boiler capacity may be reduced.

3.—Sizes of steam and return pipes, valves, fittings and pumps may be reduced.

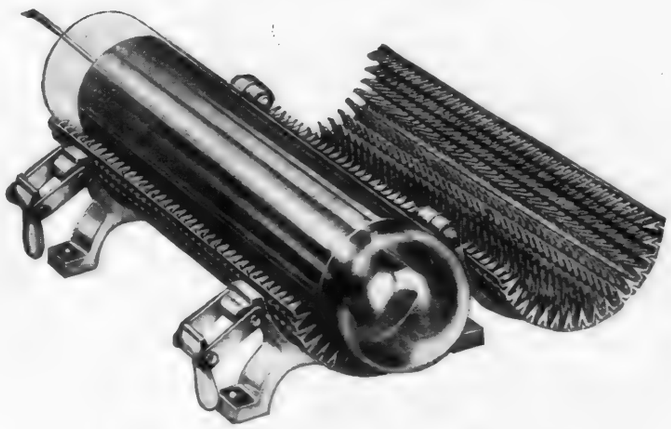
RESULTS

Pure air in rooms, free from organic odors and impurities.

The power consumed by the apparatus is extremely small, being only about 120 watts maximum for a 25,000 cu. ft. (per minute) machine when operating on alternating current. Based on an energy cost of 10c per kw. hr., this would give a cost of 12c per 10-hour day.

We will be pleased to send literature on this subject to anyone interested

Ozone Pure Airifier Co.
1403 W. Jackson Blvd.
CHICAGO, ILL.



One complete unit capable of properly ozonizing 1000 cu. ft. of air per minute. The unit is shown open to illustrate simplicity of construction and ease of cleaning.

Why does this department or that process, fall down on production?

A careful analysis of conditions will show you that in a very large proportion of cases slow output and substandard products, are due to lack of proper heat control.

Manual control of temperature is never perfect, and always expensive. Automatic control is accurate and dependable after once installed.

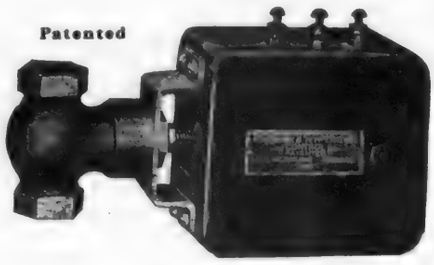
Powers Regulation is applicable to practically every condition where heat control is desirable: in offices, work rooms, shower baths and wash sinks, dry kilns, ovens, cooking vats, glue kettles, varnishing and drying rooms; and always reduces costs, loss and waste of materials; and standardizes results. It saves coal and labor, time and material.

Wrong temperature of the room men work in affects their health and their output as much as bad air, because it dulls their senses, diminishes their attention to their work, and blunts their ambition.

Let more than thirty years' experience help you.

THE POWERS REGULATOR CO
Specialists in Automatic Heat Control

954 Architects Bldg., New York
2718 Greenview Ave., Chicago
565 Boston Wharf Bldg., Boston
The Canadian Powers Regulator Co., Ltd.,
Toronto (1289B)



The
HORNUNG
Magnetic Valve

This is the little valve used as a pilot on all sizes of HORNUNG PRESSURE and TEMPERATURE CONTROL VALVES. It has many other uses.

Ask for Catalogue No. 14

CENTRAL HEAT APPLIANCES
J. C. HORNUNG
343 South Dearborn St. Chicago

Powell Valves
UNION DISC
RADIATOR VALVES

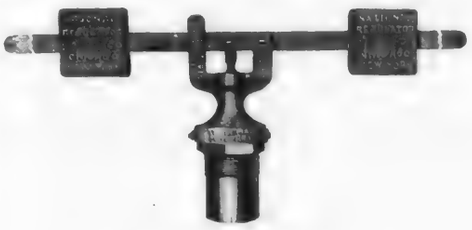
Offset corner
with male union

Made to suit every Requirement, with Unions and wood wheels, in Globe, Angle, Corner and offset patterns.

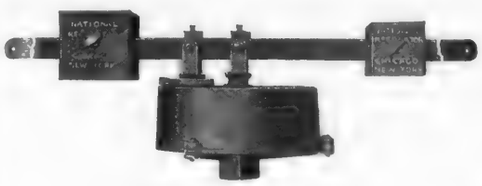
NOTE THE UNION BONNET CONSTRUCTION
Specify
"POWELL"
VALVES

Ask your dealer for Powell Valves or write us
The Wm. Powell Company
Cincinnati, Ohio

HOT WATER LOW PRESSURE



2" for Hot Water



7" for Low Pressure and Vapor

Made in 2", 4", 7" and 10" sizes

Metaphram Damper Regulators

For Low Pressure and Hot Water Boilers

also

Metaphram Regulators

For Hot water Tanks, Ovens, Pots, Driers, Refrigeration and other industrial processes.

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NATIONAL REGULATOR CO.
FACTORY AND GENERAL OFFICES
208-212 South Jefferson Street
CHICAGO

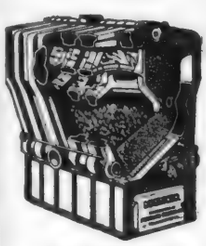
VAPOR

A-JACKS for HIGH PRESSURE

SPENCER Magazine Feed HEATERS

Spencer Heaters, because they are especially constructed to burn BUCKWHEAT Coal, cost about 1/3 less than other heaters to operate.

And Spencer Heaters, because they feed automatically, require attention only once in 12 to 24 hours. Their fire bed is always uniform and the heat even.



Successfully Burns No. 1 Buckwheat

Steam, Vapor and Hot Water Systems

Representatives in
Boston, New York, Philadelphia, Baltimore, Buffalo, Detroit, Chicago

Standard Heater Company
Williamsport, Pa.

No other metal can equal copper, for wear and service.

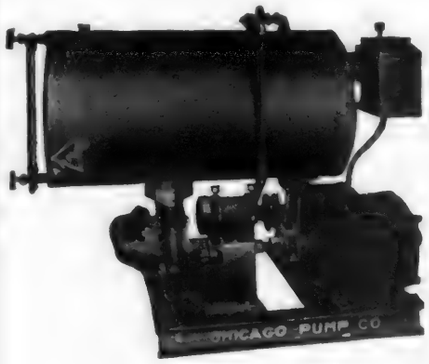
DAHLQUIST

COPPER BOILERS

are made from pure copper of the proper gauge to give strength and service.

Let us figure on your requirements

DAHLQUIST MFG. CO.
40 West 3rd St. BOSTON, MASS.



Return Line Vacuum Pump

Read these four reasons and you will readily see why we claim our pump is the best of its kind.

1. *Each element, ie., water and air, is handled by an individual pump, specially designed to handle its respective element and each pump is driven by an individual motor.*

2. *Double Automatic Control. Each pump is separately controlled so that the water pump operates only when water is to be returned to boiler, and air pump operates only when air is to be exhausted.*

3. *They are more efficient because the total horse power furnished is no more than any other efficient pump, and they run only as needed.*

4. *All pipe connections between receiver, air pump and water pump are made at the factory.*

10 more distinct advantages in bulletin 45, send for it immediately.

CHICAGO PUMP COMPANY

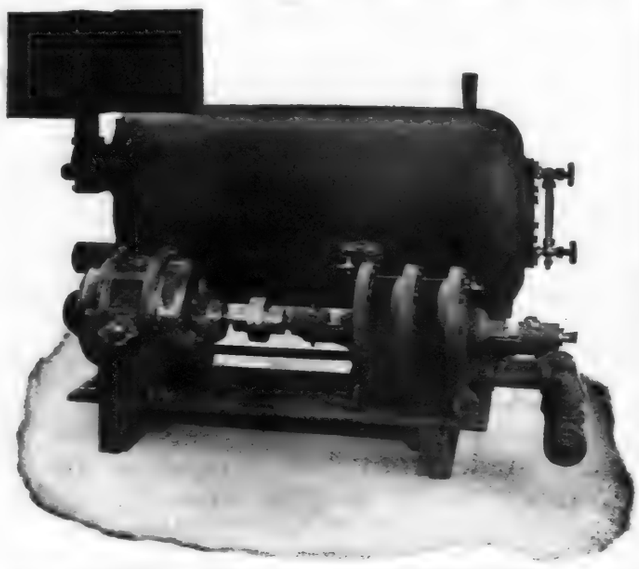
2325 WOLFRAM STREET *CHICAGO, ILLINOIS*

YEOMANS

ELECTRICALLY OPERATED

CONDENSATION RETURN PUMPS

HORIZONTAL AND VERTICAL



SPECIAL TYPE H HIGH PRESSURE UNIT

RUGGED **RELIABLE**

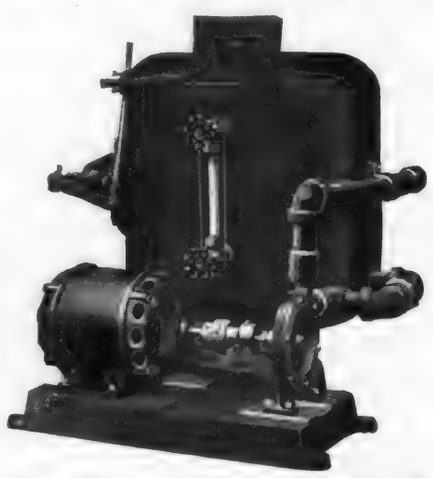
Constructed to insure long life.

Superiority proven by years of experience.

Send for Bulletin C-5100

YEOMANS BROTHERS CO., 1421 Dayton St., Chicago, Ill.

WESTERN AUTOMATIC ELECTRIC CONDENSATION PUMP and RECEIVERS



RELIABLE **SIMPLE**

A single stage pump suitable for high or low pressure ranging from 10 lbs. to 100 lbs.

The unit is very compact, mounted on cast iron base, only two pipe connections necessary when installing. The receiver is made in two sizes, of heavy cast iron. An enclosed butt contact switch is used on all pumps.

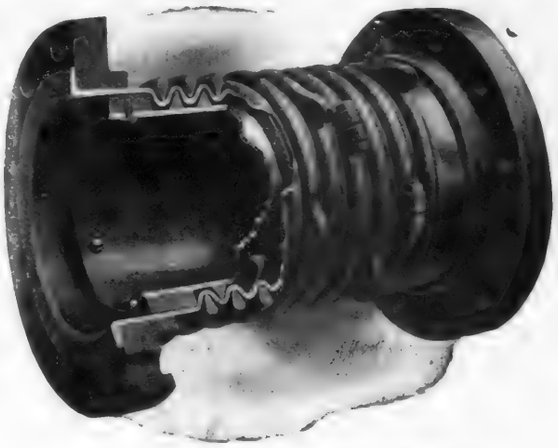
Write for Bulletin No. 220

WESTERN ENGINEERING CO.

DAVENPORT, IOWA

"WAINWRIGHT"

Improved High Pressure Expansion Joints



Wainwright Improved Expansion Joint

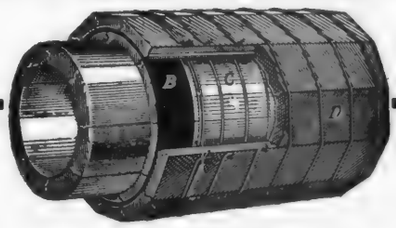
These joints of corrugated copper with reinforcing rings so arranged as to distribute the movement equally between the several corrugations are offered for steam, gas or oil lines, for not exceeding 150 pounds pressure per square inch. This design has given satisfaction where "competition" joints with fewer corrugations have failed.

Bulletin on Request

ALBERGER PUMP & CONDENSER COMPANY

140 Cedar Street, New York

Boston Chicago St. Louis Kansas City Philadelphia



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes with

Wyckoff's
Improved
Cypress Covering

Not affected by wet and dry conditions common to steam-pipe trenches. Will not rot. Absolutely water and steam tight. Each shell is wound with extra-heavy steel wire. Coated all over with the best known preservative—**Montezuma Asphalt.**

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A. WYCKOFF & SON CO.
ELMIRA, N. Y.

FOR UNDERGROUND STEAM OR HOT WATER PIPES
THE ORIGINAL
RIC-WIL METHOD

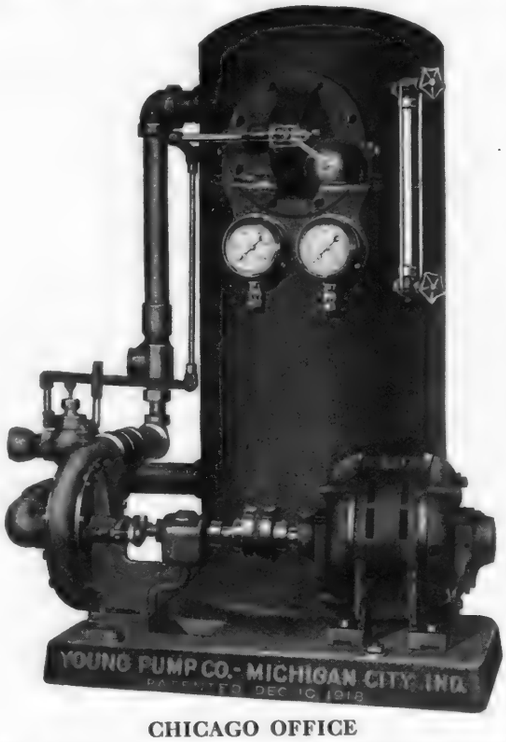
embodies more original ideas, more advanced engineering, and more good practical features than any other system on the market. The material, construction, installation methods and practical results which, combined, form what we call the RIC-WIL Method, appeal with equal force to the engineer, to the practical operating man and to the business executive. Let us send you a copy of our descriptive Bulletins 1-3.
Write to-day.

The RIC-WIL COMPANY
CLEVELAND

Young Centrifugal Vacuum and Boiler Feed Outfits

Consists of a centrifugal pump with motor direct connected, tank, exhauster and balanced by-pass valve. The pump, motor and tank are mounted on a substantial cast iron base and the outfit completely assembled as shown in the cut, so that as received on the job it is only necessary to make pipe connections to the system and boiler, wiring connections to the motor, when it is ready for operation.

It is the simplest outfit made. There are no valves, springs or other parts that require adjustment, wear out or cause repair expense; not a feature more complicated or liable to cause trouble than the motor.



Made in six sizes to handle 4,000, 8,000, 16,000, 26,000, 40,000 or 65,000 sq. ft. of radiation; for continuous operation or automatic control, to meet any condition or pressure.

Complete information and prices upon application.

Write for descriptive pamphlet.

CHICAGO OFFICE
327 S. LaSalle St. Phone Harrison 5920

CAPITOL PACKLESS QUICK OPENING VALVES

Have opposing seats.

Can be used on either pressure or vacuum systems.

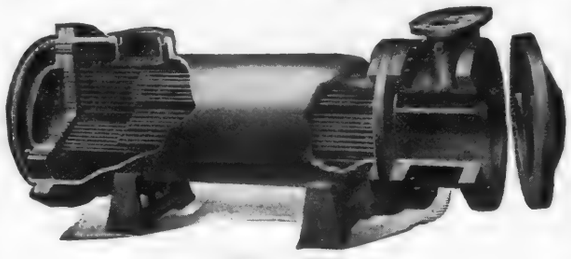
Perfect in every detail.

CAPITOL PRODUCTS ALWAYS SATISFY.

Write for catalog and prices.

CAPITOL BRASS WORKS
Detroit, Mich.

The solution of the hot water problem



G-R
INSTANTANEOUS HEATER

Hot water on tap all the time—instantaneous service! Uses either live or exhaust steam. Has the highest heat transfer factor of any closed water heater on the market. Most compact construction. *It's economical.*

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THE GRISCOM-RUSSELL CO.
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MARSH
RE-ENFORCED
PACKLESS
VALVES

Quick Opening

Note General Lines Carefully

The **ONLY Packless** and **Modulated** Valves in which the **Packless Feature,** although a **positive seal within itself** and **practically indestructible,** is, through a packing cushion and a very heavy special spring, **automatically reenforced,** providing **two or double, independent, positive,** bonnet seals at **all times.**

These valves will withstand high pressures and, therefore, are of **superior value** for **vacuum** and **low pressure service.**

We specialize on high grade Radiator Valves and furnish the largest line of any company in the business

Printed matter and prices on application

MARSH VALVE CO., DUNKIRK NEW YORK

BAILEY METERS

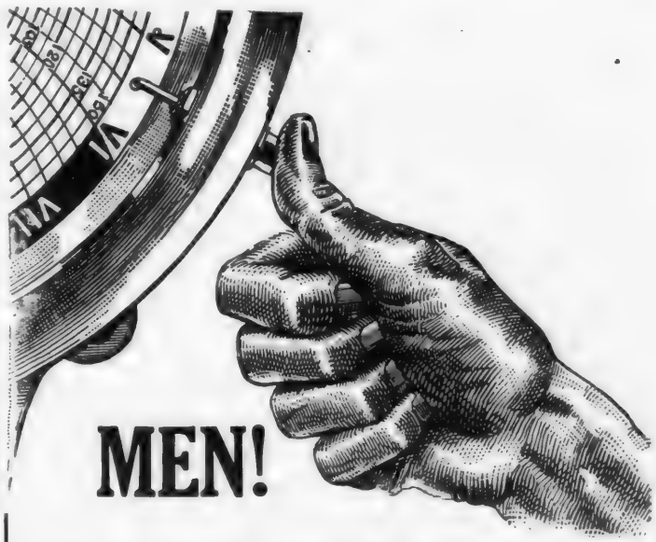
BAILEY FLUID METERS record and totalize the flow of steam at any pressure or temperature, boiler feed, condensate, circulating water, or, practically any fluid flowing in a pipe. These meters are ideal for the measurement of low pressure steam as used for heating, because pressure and temperature records may be included on the same chart, giving the complete story of the steam supply. This makes it possible to calculate the actual B. T. U. supplied to a customer, and is conclusive evidence in case of any question regarding the supply. The pressure compensator has been in service for some little time. This device automatically corrects the totalizer readings for pressure changes, so that actual steam flow may be read directly from the meter.

BAILEY BOILER METERS accomplish more real results toward obtaining maximum efficiency and capacity from boiler operation than all other meters or instruments combined, because they record rate of Steam Flow from the boiler, the Rate of Air Flow through the furnace, and the Flue Gas Temperature on a single uniformly graduated chart. The Steam Flow shows the rate of steam production. The Air Flow shows the amount of air supplied for the support of combustion. The relation between these two records shows an excess or a deficiency of air supplied for the support of combustion. The Flue Gas Temperature is a sure indication of the condition of baffles and heating surface when considered in conjunction with the other records. Wind Box Pressure and Stoker Speed as well as a totalizer for the Steam Flow may be added.

BAILEY WEIR METERS record and totalize flow of water or other liquids through V-Notch weir and are used for feed water, hot well discharge or other fluids at or near atmospheric pressure.

Other Types of Meters as well as Recording and Indicating Gauges are made for different purposes, and nearly any problem in connection with the metering of fluids can be handled. Descriptive Bulletins sent on request.

BAILEY METER COMPANY
2037-E 46th ST. CLEVELAND, OHIO



MEN!

Protect Yourselves With This Time Punch

Many a faithful employe, conscientiously performing his duties in connection with heat-treating processes, has had to stand the blame for heavy spoilage in the past—**simply because he couldn't prove he was on the job!**

In every manfacturing process calling for temperature control you can now protect yourself against unjust reprimand by means of the TIME PUNCH attachment of the Columbia Recording Thermometer.

The Day-and-Night Chart furnishes a true record of tempera ture variations, but the Time Punch operating exactly like a time clock, registers the very minute of your visit, showing beyond question that you watched the chart at stated intervals. Your employer doesn't have to take your word for it—the little punch hole in the margin of the disc, made at the instant you press the button, backs you up in your assertion that you kept your eye on the temperature. It proves that you were faithful in the discharge of your duties.

As a matter of self-protection, urge your Superintendent to install Columbia Recording Thermometers with Time Punch attachment. They cost no more than ordinary recording thermometers without this valuable feature.

The Time Punch attachment is also supplied on Columbia Recording Gauges and Tachometers.

Write today for catalog H-14

THE Schaeffer & Budenberg MFG. CO.

Makers of instruments for the promotion of efficiency in Power Plant and Manufacturing Department.

BERRY and SOUTH FIFTH STS. BROOKLYN, N. Y.

Chicago Philadelphia
Detroit Washington
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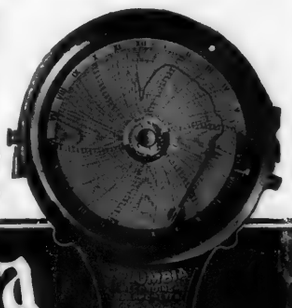

Columbia Recording Thermometers

ENGINEERS' SPECIFICATION INDEX

AIR COMPRESSORS.
Nash Engineering Co., So. Norwalk, Conn.

AIR CONDITIONING APPARATUS
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corporation, Philadelphia, Pa.
Carrier Engineering Corporation, New York.
Clarage Fan Co., Kalamazoo, Mich.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
Monsoon Cooling System, Inc., New York.
New York Blower Co., Chicage, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

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Carrier Engineering Corporation, New York.
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Grinnell Co., Inc., Providence, R. I.

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Page Boiler Co., Wm. H., New York.
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(See Air Cooling and Drying Systems.)

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Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Hornung, J. C., Chicago, Ill.
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Ric-Wil Co., Cleveland, O.
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Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
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Jas. P. Marsh & Co., Chicago, Ill.
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Ounce Graduated.
Jas. P. Marsh & Co., Chicago, Ill.
Pressure.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
American Dist. Steam Co., North Tonawanda, N. Y.
Marsh & Co., Jas. P., Chicago, Ill.
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Illinois Engineering Co., Chicago, Ill.
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What the Government Says About Heating

UNITED STATES GOVERNMENT
DEPARTMENT OF THE INTERIOR

Technical Bulletin No. 139. Pages 7 to 10.

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The burning fuel bed acts principally as a gas producer and a gas retort; in it the solid fuel is gasified by the partial combustion of the fixed carbon and by the distillation of the volatile matter.

The gases rising from the fuel bed contain at times as much as 32% combustible, and no free oxygen to burn it. Hence to burn these gases, air must be admitted over the fuel bed and mixed with the combustible, and the mixture burned in the combustion space. Of the air necessary to complete combustion of the fuel, only about one-half can be supplied through the grate; the other half must be supplied over the fuel bed.

If attempt is made to force more than this amount of air through the grate, only the rate of gasification of coal in the fuel bed is increased, while the degree of completeness of combustion as indicated by the composition of the gases leaving the fuel bed remains the same. The combustion can be completed in the combustion space only by adding enough air over the fuel bed and mixing it with the combustible.

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Young Pump Co., Michigan City, Ind.

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Nash Engineering Co., So. Norwalk, Conn.

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Nash Engineering Co., So. Norwalk, Conn.
Yeomans Bros., Chicago, Ill.

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Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
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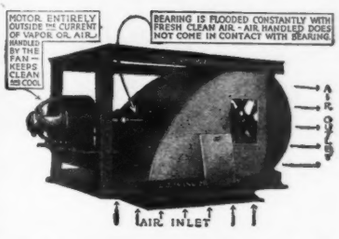
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